Operation and Maintenance Manual
NPDES Permit No. WA-000179-1
Shell Seattle Distribution Terminal

Prepared for:

Shell Oil Products US

Prepared by:

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Engineering & Environmental Services

Prepared for:
Shell Oil Products US

OPERATION AND MAINTENANCE MANUAL

NPDES PERMIT NO. WA-000179-1

SHELL SEATTLE DISTRIBUTION TERMINAL

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1.0 INTRODUCTION

1.1 Purpose

This operation and maintenance manual has been prepared to document the procedures that will be implemented by Equilon Enterprises LLC, dba Shell Oil Products US (Shell), at the Shell Seattle Distribution Terminal for compliance with its NPDES Permit No. WA-000179-1. This manual supplements the facility's existing operations and maintenance manual and is intended to focus on sources that may impact the facility's oil/water separator operations.

1.2 Manual Organization

The manual has been organized into the following sections: facility description, containment drainage procedures, oil/water separator, carbon system, special operations, and sampling and monitoring.

1.3 Emergency Notification

If the carbon treatment system or the main oil/water separator is malfunctioning, immediately notify one of the following personnel:

Name	Office Number	Home Number	Cell Number
Chuck Kolesar	206/224-0460	(b) (6)	(b) (6)
Bill Osterhout	206/224-0484	(b) (6)	(b) (6)
Frank Takahashi	310/816-2125	call cell phone	(b) (6)

If the system continues to malfunction after you have tried to troubleshoot, one of the following must be called:

1. PES Environmental Office
   (8am to 5pm, Monday through Friday) (425) 637-1905

2. PES Environmental Services
   Answering Service (24 hours, 7 day a week) (206) 726-2399

3. PES Field Cell Phone (425) 922-1542

2.0 FACILITY DESCRIPTION

2.1 Site Description

The Shell Seattle Distribution Terminal comprises 20.5 acres of land on the north central part of Harbor Island (Figure 1). The facility is divided into three parcels: the main terminal and tank farm (2555 13th Avenue SW), the north tank farm (1835 13th Avenue SW), and the shoreline manifold area and dock (1711 13th Avenue SW).

The main terminal and tank farm are located on 17.5 acres lying west of 13th Avenue SW, south of SW Florida Street, east of 16th Avenue SW, and north of SW Lander Street. The main facility consists of 2 office buildings, 2 warehouses, a blending building, a light oil truck loading rack, a lube oil truck loading rack, pipeline receipt facilities, rail receipt facilities, 1 regulated underground storage tank, 6 unregulated underground tanks (process tanks and heating oil tanks), 6 small aboveground storage tanks (waste oil from garage [2 out-of-service tanks], slop oil [reused], heating oil tanks, and a red dye tank), 83 aboveground product storage tanks, piping, pumps, a boiler, and a garage (no current garage activity). The main terminal receives primarily light oils (fuels) via the Olympic Pipe Line from Northwest Washington refineries. Lube operations, including storage and distribution, ceased in December 2003.

The north tank farm comprises 2.5 acres immediately northwest of the intersection of 13th Avenue SW and SW Florida Street. The tank farm contains two aboveground storage tanks, both about 1,500,000 gallons in size, which currently store diesel fuel, and one small aboveground red dye tank. The tanks receive product by pipelines from the Olympic Pipe Line, the main tank farm, and the dock. Product from these two tanks is also transferred to both the main terminal and the dock. No wastewater is generated from this portion of the facility.

The shoreline manifold area and dock lie on 0.5 acres of land on the north side of the intersection of 13th Avenue SW and SW Massachusetts Street. Elliott Bay is adjacent to the north edge of the shoreline manifold area. The area contains manifolds controlling the flow of product between the tank farms and the dock. The dock lies 250 feet to the west of the shoreline manifold area and extends 590 feet into Elliott Bay.

2.2 Terminal Operations

The main terminal and tank farm were built in 1947. The main terminal consists of three smaller tank farms in addition to the main tank farm: the southeast tank farm, the southwest tank farm, and the west tank farm. Other operational areas within the main terminal consist of piping systems, railcar unloading areas, the blending building, the east warehouse, the warehouse, drum storage areas, the laboratory, maintenance operations, loading racks, refueling stations, a boiler, an oil/water separator, and underground storage tanks. Current operational area locations are shown on the Drawing 1. Storm drains within the railcar unloading areas, maintenance operations, loading racks, and the main terminal tank farms drain to the oil/water separator. A brief description of the oil/water separator and carbon treatment vessels follows:

2.2.1 Oil/Water Separators

Three oil/water separators are located at the main terminal. The main oil/water separator is in the southeast corner of the main terminal; it drains to the city storm drain line at the intersection of SW Lander Street and 13th Avenue SW (Outfall 001). The main oil/water separator was constructed in 1947 and modified in October 2005. Currently, most surface drainage at the main terminal drains to the main oil/water separator. A smaller oil/water separator, constructed in 1991, is located north of the warehouse addition; it drains to the city storm drain line on the West side of 16th Avenue SW (Outfall 002). A third oil/water separator, consisting of an underground separator tank is located south of the light oil truck-loading rack. The truck wash bay drains to the King County sewer.

2.2.2 Truck-loading Rack Drainage

The main terminal currently contains two truck-loading racks, one for light fuel oils and one for lubricating oils. The light oil loading rack is located south of the garage and was constructed in 1981. Both racks are constructed with a canopy, a concrete pad, dedicated product-loading arms, and underground pipelines delivering fuel to the rack. The light oil loading rack is equipped with a vapor recovery system, a concrete pad, concrete curbs, and a series of strip drains. The strip drains lead to a 10,000-gallon underground oil/water separator tank, a particulate filtration canister, two 2,000-pound carbon treatment vessels, and ultimately the main oil/water separator. The current lubricating oil truck-loading rack was built in 1987 and is located immediately north of the northeast corner of the east warehouse.

3.0 CONTAINMENT DRAINAGE PROCEDURES

The main tank farm, the southwest tank farm, the west tank farm, and the southeast tank farm all have secondary containment to prevent the release of petroleum products in the event of a spill. The drainage systems in these tank farms (see Drawing 1) are normally kept closed which causes the accumulation of rainwater over time. Periodically the accumulated water must be drained to the oil/water separator. Prior to draining this water, the following procedures are to be completed:

1. Inspect the surface of the water contained in the tank farm. If there is no petroleum product and/or sheen present, then slowly drain the water to the oil/water separator.

2. Drainage of the main tank farm must be authorized and supervised by terminal supervisory personnel.

3. Log the drainage on the Dike Drain Report form (Form ES-1) and quarterly inspections of the containment area drainage systems on the Quarterly Dike Drain Inspection form (Form ES-2). Copies of these forms are provided in Appendix A.

4. If petroleum product and/or sheen are present, notify a supervisor or the terminal manager.

4.0 OIL/WATER SEPARATORS

4.1 System Description

The main oil/water separator is located in the southeast corner of the facility (see Drawing 1). Stormwater is conveyed to the oil/water separator by a system of catch basins and underground gravity drains. Constructed in 1947, the separator was designed to remove floating petroleum material from stormwater prior to being discharged to the municipal storm sewer. The 69-foot long by 17.3-foot wide separator was modified in October 2005 and is currently divided into three compartments as shown on Figure 2.

The northern 12.5 feet of the main oil/water separator comprises the first compartment for water entering the separator. This compartment serves as the oil/water separation compartment, with two concrete and two metal separation baffles; the first three baffles are successively deeper, serving to remove floating oil and sinking sediment from the water as it flows through the compartment. Water must flow over the last baffle through a V-notch weir to exit this compartment.

The second compartment of the main oil/water separator is 51 feet long and comprises the storage compartment, providing sufficient volume to, when combined with the storm drain volume and limited surface water ponding (east of the warehouse), store the runoff from a 10-year, 24-hour storm. Water is pumped from this compartment into the stormwater treatment system (see Section 6); if the volume of water generated from a storm were to exceed the 10-year, 24-hour storm volume, water would overflow the southern wall of this compartment (whose height is 1 foot below the top of the oil/water separator) into the third compartment. There is an underflow baffle immediately before the southern wall of this compartment to protect the third compartment.

The third compartment of the main oil/water separator is 5.5 feet long and comprises the discharge compartment of the oil/water separator. Two filter cages are located at the downstream end of the compartment. The first contains excelsior (wood fibers) for final polishing of the water before discharge. The second contains calcium carbonate gravel to provide pH control of the water. Water from the stormwater treatment system enters the eastern portion of this compartment, flows through the filter cages, and exits the western part of the compartment (the clearwell) through a concrete pipe in the southern wall.

The small oil/water separator is located on the north side of the warehouse addition. Constructed in 1991, the separator was designed to remove floating petroleum material from stormwater collected from the surrounding paved area.

4.2 Operation and Maintenance Plan

The following operation and maintenance procedures for the main oil/water separator (Outfall 001) and the small oil/water separator (Outfall 002) will be implemented at the terminal to meet conditions specified in NPDES Permit No. WA-000179-1. The facility manager will maintain and retain records of inspection, maintenance, and disposal at the terminal.

1. The oil/water separators operate 24 hours per day. Runoff from the enclosed tank farm and product transfer area will be directed to the main oil/water separator for separation and filtration before discharge to Outfall 001. Runoff from the paved area north of the warehouse and roof drainage from the east side of the warehouse will be directed to the small oil/water separator for treatment before discharge to Outfall 002.

2. The main and small oil/water separator systems will be visually inspected **DAILY** to ensure that no visible sheen is present in the discharge. The visual inspection is accomplished by looking through the clearwell at the end of the main separator and through the last compartment of the small separator. If sheen is noted, absorbent pads, booms, or both will be changed out (see No. 5 below), and the source of the sheen will be investigated. Results of the inspections will be entered on an NPDES Monitoring Daily Log Form (Form ES-3). Form ES-3 is provided in Appendix A.

3. A pH reading will be taken **DAILY** in the main separator by using pH paper or a pH meter. Readings will be taken upstream of the filter cages and downstream of the filter cages in the clearwell (Outfall 001). A pH reading will be taken **MONTHLY** in the small separator clearwell (Outfall 002) using either pH paper or a pH meter. If a pH meter is used, the meter will be calibrated, cleaned, and operated accordingly to the manufacturer's instructions. Results will be entered on the NPDES Monitoring Daily Log Form (Form ES-3). The Outfall 001 and 002 pH readings are to be between 6.5 and 8.5. If a pH is measured outside the range of 6.5 to 8.5, the following procedure will be followed:

   A. The probe will be cleaned and recalibrated; the measurement will be repeated with a fresh sample. If the pH reading is in the acceptable range, no additional investigation will be performed. The reading generated after probe cleaning and calibration will be the one recorded on the NPDES Monitoring Daily Log Form.

   B. If the pH measurement is still outside the acceptable range, the result will be compared to the recent rainfall pH readings, if available. If the separator pH reading is in the range of the rainfall pH readings, no additional investigation will be performed.

   C. If after probe cleaning and recalibration the separator pH reading is still outside of the acceptable range and outside of the range of the rainfall pH readings, the results will be reported to the terminal manager for reporting to the Department of Ecology (Ecology), and the source will be investigated.

4. Absorbent pads and/or a boom will be placed in the third compartment of the main oil/water separator and the third chamber of the small oil/water separator to ensure effective system performance. The absorbent pads and/or boom in the main oil/water separator will also be visually inspected **DAILY**. If sheen is observed and the pads, boom, or both appear saturated, they will be replaced.

5. The excelsior filters will be inspected visually **QUARTERLY**. The filters will be replaced when they are saturated (i.e., every six months to one year).

6. The calcium carbonate filter will be pressure washed **QUARTERLY** and replaced when shown to have lost effectiveness or at least **ANNUALLY**.

7. The rain gauge will be inspected **WEEKLY**. The rain gauge will be cleaned and calibrated according to the manufacturer's instructions.

8. The water surface of the small oil/water separator will skimmed **ANNUALLY**. Oil/water separator sludge will be removed when the accumulation impacts system operation efficiency, or about every five years for the main oil/water separator (approximately every two to three years in the small oil/water separator), whichever is shorter. The sludge will be disposed of in accordance with Washington State and Federal regulations for waste disposal.

9. After the sludge is removed, the separators and clearwell will be cleaned and visually inspected to ensure that the integrity of the system has been maintained. If repairs to the system are needed, they will be made before the system is put back into service. Alternative storage of water (e.g., a Baker tank) will be used while the system is out of operation.

10. Structural Integrity Inspections:

    - Oil/Water Separators — when potential problems are suspected or during sludge removal.
    - Tank 400 — per API-653 procedures and WAC 173-180A.
    - Catch Basins and Drainage Piping — as needed, usually when oil/water separator is cleaned (approximately every 5 years).

11. Inspection Record:

Task/Work Performed	Date
Oil/water separators cleaned, inspected, and coated with epoxy	September 1995
Catch basins cleaned and inspected	September 1995
Tank 400 cleaned and inspected (per API-653)	October 1995
Drainage piping and catch basins cleaned and inspected	March 1998
Small oil/water separator cleaned, catch basins cleaned	Early 2001
Main oil/water separator cleaned and inspected	June 2001
Excelsior and calcium carbonate filter cages in main oil/water separator repaired	July 2004
Catch basins cleaned and inspected	August 2004
Main oil/water separator cleaned and inspected	September 2005
Main oil/water separator cleaned, inspected, and modified to improve oil/water separation, stormwater storage, and stormwater treatment for zinc	October 2005

4.3 Oil/Water Separator Emergency Procedures

The main oil/water separator is designed to passively remove floating oil and zinc (particulate and dissolved) from stormwater collected at the facility. The small oil/water separator is designed to passively remove floating oil from the stormwater collected at the facility. Both separators are operated as "flow-through" systems as opposed to "batch" processes. Any oil accumulation that is observed in the small oil/water separator during routine inspections will be pumped into a drum or tank immediately.

The main oil/water separator discharge valve is normally open allowing treated stormwater to be discharged on demand. In the event of an emergency spill or release which could migrate to the separator, procedures must be undertaken to prevent their discharge. The following procedures will be implemented in response to a spill (or if test results indicate that water in the main separator exceeds NPDES discharge monitoring standards):

4.3.1 Low-Flow Conditions (during or after a light rainfall)

1. Notify terminal supervisor and manager immediately.
2. Close oil/water separator discharge valve.
3. Turn off submersible lift pumps for the stormwater treatment system.
4. Pump accumulated water/product from the clear well to Tank 400 (approximately 15,000-gallon capacity)
5. Analyze the water and handle as appropriate and recycle accumulated product to the Puget Sound Refinery.

4.3.2 High-Flow Conditions (during or after a heavy rainfall)

1. Notify terminal supervisor and manager immediately.
2. Close oil/water separator discharge valve.
3. Order portable tanks from either.

Baker Tanks
6100 238th Street SE
Woodinville, Washington 98072
(425) 487-6503 or (800) 225-3712

or

Rain for Rent
19430 59th Avenue NE
Arlington, WA 98223
(360) 403-3091or (800) 742-7246

4. Pump from clear well to portable tank.

5. Analyze water and product, and handle as appropriate.

5.0 SPILL CONTAINMENT TANK AND CARBON SYSTEM

This section documents the light oil rack underground separator maintenance procedures, carbon system description, carbon system monitoring requirements, troubleshooting procedures, and maintenance requirements for the carbon treatment system at the Shell Seattle Distribution Terminal. The operator will follow these procedures during daily operations and if an emergency occurs.

5.1 System Description

The Shell carbon treatment system was installed in January 1995 to control the discharge of gasoline compounds from the light oil load rack underground separator/spill containment tank to the main oil/water separator. The system consists of the following: collection sump, two sump pumps (that cycle on an alternating basis), flow equalization tank, transfer pump, two carbon filtration canisters, a particulate filtration canister, an electrical supply and control system, and associated piping (Figure 3).

Runoff collected from the fuel loading area strip drains is routed to the underground separator/spill containment tank. The separator discharges water only into the collection sump. Water from the collection sump is pumped into the equalization tank. The transfer pump directs water from the equalization tank through the particulate filtration canister to the carbon filtration canisters. After the water is carbon treated, it discharges into a storm drain that empties into the main oil/water separator. The system normally operates automatically by using water level sensors. It can, however, also be operated manually.

5.2 Spill Containment Tank Inspection and Maintenance

An underground separator/spill containment tank is located at the light oil fuel loading rack. The tank acts as an oil/water separator for small amounts of light fuels that may be released during the filling of trucks.

Tank inspections will be done on a weekly basis and recorded on the NPDES Monitoring Daily Log Form (Form ES-3). If there is fuel in the tank, the fuel will be transferred to the commingle tank on a weekly basis to reduce the potential benzene, toluene, ethylbenzene, and total xylenes (BTEX) concentrations requiring treatment. This procedure will reduce the amount of BTEX-impacted water requiring treatment and extend the life of the carbon system.

5.3 Carbon System Operations

5.3.1 System Monitoring

System monitoring includes checking the system control panel, alarm indicators, and carbon canister operating pressure. Figure 4 provides a detailed schematic drawing of the system control panels.

Check the **system control panels** daily for the following conditions:

1. The **main power safety switch** should be in the "on" position.

2. The **system control switch** should be in the "on" position.

3. The **sump pump and transfer pump switches** should be in the "auto" position (the indicator lights will be on only if the pumps happen to be operating during the inspection).

4. The **sump high-level and tank high-level alarm lights** should not be on.

A more detailed inspection of the system will be performed monthly and recorded on the Light Oil Fuel Rack Carbon Treatment System Inspection Log (Form ES-4). Form ES-4 is provided in Appendix A. Check the control panel, sump pumps, equalization tank, and carbon canisters as outlined on the form. Check the **primary carbon canister pressure gauge** (pressure gauge P3 shown on Figure 2). The pressure indicator should read less than 12 pounds per square inch (psi) when pumping. The pressure can be adjusted by opening or closing the control valve on the inlet line before the carbon filtration canisters.

5.3.2 Troubleshooting

Under normal operation, the sump and transfer pump operate in the automatic mode. The "pump on" indicators are controlled by level sensors which cycle the pumps on and off. The flow rate through the carbon canisters should be between 20 and 30 gallons per minute (gpm). The maximum allowable inlet pressure for the carbon filtration canisters is 12 psi.

Sump high level alarm condition (indicator light is on) means that water is bypassing the carbon treatment system and flowing directly to the storm drain. There are four reasons this light could be on:

Possible Problem	Operation Check	Action
One of the two (or both) sump pumps could be clogged or malfunctioning.	Turn sump pump switch to manual mode to check pump operation.	If pump(s) is not operating call the terminal supervisor or manager and electrician immediately.

Possible Problem	Operation Check	Action
The inflow from the underground separator spill tank could be more than the pump discharge capacity.	Turn the sump pump switch to manual to check the pump operation and check pump discharge into equalization tank for restrictions of the full flow capability.	If pump is not operating, call the terminal supervisor or manager and electrician immediately. If flow is restricted, check for blockages in collection sump. Remove if possible.
The system control panel and/or sensors could have a malfunction: – electrical problem – tripped circuit breaker – float switch problem	Check circuit breaker if pump will not operate in manual mode. Check sensors/float switches in collection sump if pump works in manual, but not in automatic mode.	If automatic mode does not work, allow pumps to pump in manual mode. **Caution**: the pumps cannot be left running when the collection sump is empty. Notify terminal supervisor or manager immediately to arrange repairs.
The sump pump has been automatically turned off because the equalization tank high level alarm was triggered (both alarm lights will be on).	Check equalization tank float switches.	Call terminal supervisor manager and the electrician.

Equalization tank high level alarm condition shows that the tank is about to overfill. There are four reasons this light could be on:

Possible Problem	Operation Check	Action
The transfer pump could be malfunctioning.	1. Use manual mode to check for pump operation. 2. Check fuses if pump will not operate in manual mode. Check sensors if pump works in manual but not in automatic mode.	If pump cannot be restarted, call terminal supervisor or manager and an electrician.
Transfer pump water inlet may be blocked.	If possible, use a long pole (gauge stick) to determine if an object(s) is blocking the equalization tank effluent port.	If object is blocking the equalization tank effluent port, try to dislodge the object with the pole. If the pump cannot be reactivated, call the terminal supervisor or manager.
The particulate filter influent flow rate is reduced, preventing adequate transfer flow rate from the equalization tank to the carbon units.	Check the influent flow rate by verifying that the pressure difference across the particulate filter (P1-P2) is less than 15 psi (typical operation is less than 5 psi).	If pressure difference is elevated (15 psi or greater), change the filter cartridges and return to service. Check for inlet blockage.

Possible Problem	Operation Check	Action
The primary carbon vessel flow rate is reduced, preventing adequate transfer flow rate from the equalization tank to the carbon units.	1. Check primary carbon influent pressure by verifying that the pressure is less than 12 psi (P3). 2. Check flowrate through the carbon canisters by verifying that the flowrate is between 20-30 gpm. 3. Check automatic bleed valves on top of the carbon canisters to ensure proper operation.	1. Adjust carbon influent valve such that P3< 12 psi and flowrate is between 20-30 gpm. 2. If flowrate is too low when P3<12 psi, then arrange to back flush the primary carbon unit. 3. Replace fouled or inoperable automatic bleed valves, as needed.

5.3.3 Maintenance

Discharge from the first carbon canister to the second will be field tested or sampled periodically to assess and maintain good filtration. Field testing is performed as follows:

1. Influent, effluent, and mid-system water samples will be collected every 6 months. The water samples will be submitted to a laboratory for analysis of BTEX by United States Environmental Protection Agency (USEPA) Method 8021.

2. If petroleum hydrocarbons are present at the intermediate location, remove the first carbon canister and replace it with the second canister and replace the second canister with the new canister. Use care to assemble the vessels in the proper No. 1 and No. 2 sequence. The former canister labeled No. 2 should be relabeled No. 1, and the new canister should be labeled No. 2.

3. Install the new carbon filtration canister per the installation and startup instructions (manufacturer instructions are enclosed in Appendix B).

The carbon treatment system includes a particulate filter that has been installed just prior to the primary carbon unit. The particulate filter is a Rosedale Model 8 cartridge filter containing six 30-inch wound cartridges (nominal 10-micron). The purpose of this filter is to remove particulate material that would otherwise prematurely plug the carbon units. The particulate filter must be maintained by replacing the filter cartridges when the pressure across the filter exceeds 15 psi. Replacement cartridge filters for this unit are usually a stock item, so it is not advisable to operate the treatment system without cartridge filters in place.

To determine the particulate filter back-pressure, activate the **transfer pump** and read the difference in the pressure across the filter vessel from pressure gauges P1 and P2 located on the front side of the filter housing. If the gauge differential reads greater than 15 psi, shut the system down and replace the filter cartridges. A specification sheet with cartridge ordering instructions is provided in Appendix B. To replace the cartridges:

1. Shut the system down by deactivating the **main power safety switch** at the **system control panel**.

2. Check the inlet pressure gauge on the particulate filter to ensure the pressure is zero (0 psi). If it is not 0 psi, then slowly open the pressure bleed valve on the top of the filter housing, if installed. If the bleed valve is an automatic bleed valve style and the pressure is not 0 psi, then replace the bleed valve.

3. Open the filter housing and remove and replace the filter cartridges per the manufacturer's (Rosedale) instructions included in Appendix B.

4. Close and reseal the filter housing and start system to confirm leak-free operation.

5. Turn on transfer pump, fill filters with water, and bleed off any air trapped in the filter housing.

6. Note operating pressure readings after filter replacement.

5.4 Winter Conditions Operations

Current cold-weather system protection includes heat tape on pipelines, heat blankets on the carbon canisters, and insulation over the entire system. Additional precaution and inspections should be implemented, as necessary, during winter conditions with extensive subfreezing temperature. The system and associated pipelines should be inspected daily for integrity during periods of subfreezing temperatures.

The carbon canisters have been labeled as No. 1 and No. 2, to designate their order in series, and their date of installation. They have been clearly identified so they can be reassembled in the event they are dismantled during winter maintenance operations. Use care to reassemble the vessels in the proper No. 1 and No. 2 sequence if the vessels have to be moved for any reason.

6.0 STORMWATER TREATMENT SYSTEM

This section documents the stormwater treatment system description, monitoring requirements, troubleshooting procedures, and maintenance requirements. The operator will follow these procedures during routine operations and if an emergency occurs. Appendix C provides the manufacturer's maintenance guidelines.

6.1 System Description

The Shell stormwater treatment system was installed in October 2005 to treat stormwater so that discharge through Outfall 001 meets the permit limit for zinc. The system consists of the following (Figures 2 and 5): two 130-gallons per minutes (gpm), 1.5-horsepower lift pumps (that cycle on an alternating basis); two aboveground, precast, Stormwater Management (now Stormwater 360) StormFilter® vaults each filled with 35 filter cartridges containing Metal Rx™ filtration media; transfer piping between the oil/water separator and stormwater treatment vaults; and an electrical supply and control system (Figure 6). Appendix C provides descriptions of the stormwater treatment system control panel and float switches, and the StormFilter® manufacturer's reference material.

The stormwater treatment system operates by pumping stormwater from the second compartment of the oil/water separator through subsurface and aboveground PVC pipes to the primary treatment vault located approximately 25 feet west of the oil/water separator on the east side of the eastern warehouse (Drawing 1). Stormwater then gravity drains through the primary treatment vault, through piping to the secondary treatment vault, through the secondary treatment vault, and then into the third compartment of the oil/water separator.

During routine operations, the lift pumps operate automatically using water level sensors and cycle on an alternating basis. There are two level sensor trees (LSLH-101 and LSH-104). LSH-104 is the oil/water separator high level alarm light and horn switch indicating stormwater treatment system bypass. LSLH-101 consists of four float switches as follows:

1. LSL-101: low level pump shut-off switch;

2. LSH-101: high level pump on switch;

3. LSHH-101: high-high level back-up pump on switch that also activates the high level alarm light and horn; and

4. LSLL-101: low-low level alarm light and horn switch.

The pumps are also controlled by two sets of float switches, FSH-102 and FSL-103. FSH-102 turns on the back-up pump if the flow rate through the V-notch weir is high enough. FSL-103 is a switch that activates the pump low-flow warning alarm light and horn.

If the water level is high enough in the second compartment of the oil/water separator or the rate of water level rise is high enough, both pumps are operated. The lift pumps can also be operated manually. The filter cartridges in the vaults contain fine, granular, organic filter media made from deciduous leaves and work passively by trapping particulates and adsorbing metals.

6.1 System Inspection and Maintenance

Three types of maintenance will be performed on the stormwater treatment system: minor maintenance, major maintenance, and event-based maintenance.

1. Minor maintenance will be performed on a quarterly basis for the first year of system operation and will involve inspection of the two StormFilter® vaults; removal of vegetation, trash, or other debris, if necessary; collection of influent, mid-point, and effluent water samples when there is flow through the treatment system; and flow testing of the lift pumps. The frequency of minor maintenance events will be re-evaluated based on the data collected during the first year of operation and maintenance.

2. Major maintenance will be scheduled and performed based on the results of the minor maintenance events; major maintenance will involve replacement of the cartridge media and removal of sediment from the vaults.

3. Event-based maintenance will be conducted after major storm events or petroleum spills that reach the main oil/water separator; this type of maintenance will involve inspection of the vaults, removal of any collected debris, and water quality sampling (if a petroleum spill has occurred).

Following are maintenance procedures based on the manufacturers guidelines.

6.1.1 Minor Maintenance Procedures

Following are procedures for minor maintenance events, including system inspection, minor vault cleaning, and system water sampling. These procedures may be modified based on experience gained during system maintenance.

1. Use the appropriate safety equipment for work performed in and around the vaults.

2. Observe the external condition of each vault and record the observations on an inspection form (see Appendix C). Include observations of any terminal activities that may have an impact on the stormwater treatment system.

3. Observe and note on the inspection form the condition of the inside of each vault, including the condition of the individual components of the vault; the amount of and location of any vegetation, trash, or other debris; the level of sediment on the floor of the vault and on top of the cartridges; the level of water in the vault; and the approximate flow rate of water through the vault.

4. Remove any vegetation, trash, or debris if possible from each vault using a pole with a hook or net on the end. Dispose of the material appropriately.

5. Observe the stormwater treatment system control panel. The alarm lights (low level, high level, pump fail, pump seal leak, float switch, bypass condition, and overflow) should be off. The main power safety switch should be in the "on" position, and both of the pump control switches should be in the "auto" position. Record the observations on the inspection form (Appendix C).

6. Observe the lift pumps, if possible. Note the condition of the pumps, and remove any accumulated debris around the pumps with a pole with a hook or net on the end.

7. Collect water samples from the first filter vault inlet, the second filter vault inlet (mid-point sample), and oil/water separator discharge in laboratory-provided metals sampling bottles. Submit the samples with the proper chain-of-custody form to an analytical laboratory for analysis of zinc using USEPA Method 200.7.

6.1.2 Major Maintenance Procedures

Following are procedures for major maintenance events, including replacement of the filter cartridge media and removal of accumulated sediment in the vaults. These procedures may be modified based on experience gained during system maintenance.

1. Use the appropriate safety equipment for work performed in and around the vaults.

2. Observe the external condition of each vault and record the observations on an inspection form (see Appendix C). Include observations of any terminal activities that may have an impact on the stormwater treatment system.

3. Observe and note on the inspection form the condition of the inside of each vault, including the condition of the individual components of the vault; the amount of and location of any vegetation, trash, or other debris; the level of sediment on the floor of the vault and on top of the cartridges; the level of water in the vault; and the approximate flow rate of water through the vault.

4. Remove any vegetation, trash, or debris if possible from each vault using a pole with a hook or net on the end. Dispose of the material appropriately.

5. Enter the vault, and remove the filter cartridges to be replaced from the vault using the manufacturer's procedures (see Appendix C).

6. Remove deposited sediment on the floor of the vault with a shovel or vacuum truck.

7. Observe the condition of the inside of the vault and condition of the manifold and connectors (2-inch-diameter PVC pipes protruding from the floor of the vault). If necessary, replace any damaged connectors and apply a light coating of silicon grease to the outside of the connectors (for a watertight fit).

8. Using a boom, crane, or tripod, lower and install the new filter cartridges.

9. Observe the stormwater treatment system control panel. The alarm lights (low level, high level, pump fail, pump seal leak, float switch, bypass condition, and overflow) should be off. The main power safety switch should be in the "on" position, and both of the pump control switches should be in the "auto" position. Record the observations on the inspection form (Appendix C).

8. Observe the lift pumps, if possible. Note the condition of the pumps and remove any accumulated debris around the pumps with a pole with a hook or net on the end.

10. For future comparison to baseline data, collect water samples from the first filter vault inlet, the second filter vault inlet (mid-point sample), and oil/water separator discharge in laboratory-provided metals sampling bottles. Submit the samples with the proper chain-of-custody form to an analytical laboratory for analysis of zinc using USEPA Method 200.7.

11. Appropriately store, sample, and dispose of residual sediment and filter media.

12. Contact Stormwater 360 at 1-800-548-4667 to return the used filter cartridges.

6.1.3 Event-Based Maintenance Procedures

Following are procedures for event-based maintenance events, to be implemented after a major storm event or petroleum spill that reaches the main oil/water separator.

1. Use the appropriate safety equipment for work performed in and around the vaults.

2. Observe the external condition of each vault and record the observations on an inspection form (see Appendix C). Include observations of any terminal activities that may have an impact on the stormwater treatment system.

3. Observe and note on the inspection form the condition of the inside of each vault, including the condition of the individual components of the vault; the amount of and location of any vegetation, trash, or other debris; the level of sediment on the floor of the vault and on top of the cartridges; the level of water in the vault; and the approximate flow rate of water through the vault.

4. Remove any vegetation, trash, or debris if possible from each vault using a pole with a hook or net on the end. Dispose of the material appropriately.

5. Observe the stormwater treatment system control panel. The alarm lights (low level, high level, pump fail, pump seal leak, float switch, bypass condition, and overflow) should be off. The main power safety switch should be in the "on" position, and both of the pump control switches should be in the "auto" position. Record the observations on the inspection form (Appendix C).

6. Observe the lift pumps, if possible. Note the condition of the pumps and remove any accumulated debris around the pumps with a pole with a hook or net on the end.

7. Based on the size of the spill, the distribution of the product in the main oil/water separator, and the timing of the lift pump shutdown, influent, mid-point, and effluent water samples may need to be collected to evaluate the condition of the vaults. If so, collect water samples from the first vault inlet, the second vault inlet (mid-point sample), and the oil/water separator discharge in laboratory-provided metals sampling bottles. Submit the samples with the proper chain-of-custody form to an analytical laboratory for analysis of zinc using USEPA Method 200.7 and petroleum hydrocarbons (see Table 2).

6.2 Troubleshooting

Under normal operation, the lift pumps operate in the automatic mode. The "pump on" indicators are controlled by level sensors that cycle the pumps on and off. The flow rate from each lift pump should be approximately 130 gpm.

High level alarm condition (indicator light is lit and the horn is sounding) means that either high-high level switch LSHH-101 has been tripped, activating the back-up pump, or high level switch LSH-104 has been tripped, indicating that water is bypassing the stormwater treatment

system and flowing directly into the third compartment of the oil/water separator. There are four reasons this light could be on:

Possible Problem	Operation Check	Action
One of the two (or both) lift pumps could be malfunctioning.	Turn each lift pump switch to the manual mode to check pump operation.	If pump(s) is not operating call the terminal supervisor or manager and electrician immediately.
The system control panel and/or sensors could have a malfunction: – electrical problem – tripped circuit breaker – float switch problem – flow switch problem	Check circuit breaker if pumps will not operate in manual mode. Check sensors/float switches in oil/water separator if pumps work in manual mode but not in automatic mode. Check that flow switch FSH-102 turns on the back-up pump.	If automatic mode does not work, allow pumps to pump in manual mode. The pumps cannot be left running when the oil/water separator is empty. Notify terminal supervisor or manager immediately to arrange repairs.
The flow rate through the stormwater treatment system could be reduced due to a blockage.	Turn each lift pump switch to manual to check pump operation and check pump discharge into the primary treatment vault to confirm full flow capability. If possible, use a long pole (gauge stick) to determine if an object(s) is blocking the pump intakes.	If flow is restricted, check for blockages at lift pumps and in treatment vaults. Remove if possible.
The inflow to the main oil/water separator could be more than the designed capacity of the stormwater treatment system (260 gpm).	Check the flow rate from the oil/water separator compartment through the weir, if possible. Turn each lift pump switch to manual to check pump operation and check pump discharge into the primary treatment vault to confirm full flow capability.	If the stormwater treatment system is fully operational but not keeping up with inflow to the oil/water separator, call the terminal supervisor or manager to document the extreme rainfall event. Document approximate bypass volume. Bypass overflows must be documented and reported to Ecology.

Low-low level alarm condition shows that the lift pumps are continuing to pump when not needed. There is one reason this light could be on:

Possible Problem	Operation Check	Action
The system control panel and/or sensors could have a malfunction: – electrical problem – float switch problem	Check sensors/float switches in oil/water separator if pumps work in manual mode but not in automatic mode.	If automatic mode does not work, turn off the pumps to allow the water level in the second compartment of the oil/water separator to rise. Manually monitor the water level and start the pumps, as necessary. Notify terminal supervisor or manager immediately to arrange repairs.

Pump fault alarm condition shows that the lift pumps are not operating properly. There are three reasons this light could be on:

Possible Problem	Operation Check	Action
One of the two (or both) lift pumps could be malfunctioning.	Turn each lift pump switch to the manual mode to check pump operation.	If pump(s) is not operating properly call the terminal supervisor or manager and electrician immediately.
The flow rate through the stormwater treatment system could be reduced due to a blockage.	Turn each lift pump switch to manual to check pump operation and check pump discharge into the primary treatment vault to confirm full flow capability. If possible, use a long pole (gauge stick) to determine if an object(s) is blocking the pump intakes.	If flow is restricted, check for blockages at lift pumps and in treatment vaults. Remove if possible.
The system control panel and/or sensors could have a malfunction: – electrical problem – tripped circuit breaker – flow switch problem	Check circuit breaker if pumps will not operate in manual mode. Check low flow switch (FSL-103) to see if operating properly.	If automatic mode does not work, allow pumps to pump in manual mode. The pumps cannot be left running when the oil/water separator is empty. Notify terminal supervisor or manager immediately to arrange repairs.

6.3 Winter Conditions Operations

The pipes in the stormwater treatment system are protected from freezing since most are underground and those that are aboveground should not be full of water during periods of subfreezing temperatures. According to the manufacturer, the filter cartridges drain between storm events and should not be full of water during periods of subfreezing temperatures. To confirm that no aboveground pipes have cracked, additional inspections (minor maintenance) should be implemented, as necessary, during winter conditions with extensive subfreezing temperatures. The necessity of these inspections will be re-evaluated based on the data collected from inspections performed during winter conditions with extensive subfreezing temperatures.

7.0 SPECIAL OPERATIONS

Special operations (e.g., firefighting system tests, tank hydrotest) occur at the Terminal on a varied basis. To ensure compliance with Shell's NPDES permit, the following procedures have been established for these operations.

7.1 Truck Rack Firefighting System

The light fuels truck rack is equipped with an automatic firefighting foam sprinkler system. In the event of a fire, the foam system is activated spreading foam over the entire area of the rack. At regular intervals (water flow is tested annually) and when ordered by the fire department, the foam system must be tested by activating the system for approximately 15 minutes. Diverters have been installed to eliminate the need to dump foam during tests. The diverters allow a small

amount of foam to be diverted to a sample container, thus eliminating the generation of foam during tests.

The following procedures will be performed in conjunction with firefighting system tests if foam were to be used in a flow test:

7.1.1 Foam Application Test

1. In advance of the test, provisions will be made to have two vacuum tankers (or a portable 20,000 gallon tank) on site (approximately 10,000-gallon tankage capacity) capable of pumping a minimum of 250 gpm each. One truck will be staged near the southwest drain discharge and the other near the southeast drain discharge.

2. The truck rack strip drains will be plugged where they discharge to the underground separator/spill tank. It is critical that no foam be allowed to enter the underground separator/spill tank.

3. The vacuum truck operators will position their suction hoses inside the strip drains at the southeast and southwest corners. Vacuum will be applied to the drains when the foam test begins. Note: foam may be generated inside the vacuum tankers - the vacuum discharge port should be positioned so that ejected foam will stay within the truck rack drainage area.

4. After completion of the foam test, the residual foam will be washed into the strip drains and collected in the vacuum tankers. When the area has been cleaned, the strip drain discharge plugs will be removed.

7.1.2 Annual Water Flow Test

Flow restrictors are to be placed in each discharge drain pipe leading from the rack to the underground oil/water separator tank. Flows should not be allowed to cause an overflow to occur in the collection sump. This would allow untreated water to flow to the main oil/water separator.

7.2 Truck Rack Spill Response/Bypass Prevention

In the event of a spill at the truck rack, care will be taken to insure that no spill residues or contaminated water are released to the facility's stormwater collection system. Small spills such as inadvertent spillage during tanker loading may be accommodated in the normal operation of the underground separator/spill containment tank - carbon treatment system. Larger spills, however, may generate large volumes of washwater and/or product which must be collected, segregated, and either specially treated on site or hauled off site for disposal.

For major spills, allow the material to pass through the underground separator/spill containment tank and be pumped to the equalization tank while the carbon filter transfer pump switch is in the "off" position. This will collect the waste in the equalization tank but prevent it from being

transferred to the carbon filters and subsequently to the stormwater collection system. Portable tanks and/or vacuum tankers will be used, if required, to store contaminated water and spilled product.

The underground separator/spill containment tank will be checked for free product weekly or after any significant spill, per the procedure outlined in Section 5.2. Any significant product accumulation in the tank should be removed immediately (should be done after any significant spill).

7.3 Tank Water Draws

Periodically, fuel product storage tanks accumulate water which must be removed to protect the product quality. This water is referred to as tank bottom draw water and must be collected and disposed of off site. Tank bottom draw water will not be discharged to the facility's stormwater collection system or sanitary sewer. Provisions will be made to remove this wastewater by pumping to a temporary holding tank with subsequent shipment off site, or by pumping directly to a tanker truck or rail tanker car.

7.4 Unanticipated Discharges

Shell's National Pollutant Discharge Elimination System (NPDES) Waste Discharge Permit No. WA-000179-1 requires that Shell obtain approval in advance of discharging water from non-routine operations (e.g., tank hydrotesting). This authorization is issued by:

Washington State Department of Ecology
Northwest Regional Office
Water Quality-Industrial Section-WDIS
3190 - 160th Avenue S.E.
Bellevue, Washington 98008-5452

Prior to any such discharge, Shell will contact the Department and **at a minimum** provide the following information:

1. The nature of the activity that is generating the discharge.
2. Any alternatives to the discharge, such as reuse, storage or recycling of the water.
3. The total volume of water expected to be discharged.
4. The results of the chemical analysis of the water. The water shall be analyzed for all constituents specified by Ecology.
5. The rate at which the water will be discharged, in gallons per minute.

Alternatively, a temporary discharge approval can be obtained from King County by contacting the King County Industrial Waste Section. They require analysis of the water for BTEX, lead, oil and grease, and non-polar fats, oil, and grease. The data will be reviewed by King County,

and a temporary authorization granted to discharge up to 25,000 gallons per day to the King County sewer system.

8.0 SAMPLING AND MONITORING

This section has been developed to ensure that sampling and monitoring will be conducted in accordance with the monitoring and sampling requirements identified in NPDES Permit No. WA-000179-1 for the Seattle Distribution Terminal. The sampling and monitoring procedures, laboratory requirements, and reporting requirements are presented below:

8.1 Sampling and Monitoring Procedures

The sampling and monitoring procedures are presented below by sampling interval. They will be implemented by a trained inspector/sampler. The sample type, the date, the exact place (e.g., Outfall 002), the time of sampling, and the sampler's name must be recorded for each measurement or sample taken. Specific reporting requirements are presented in the respective section of this plan.

8.1.1 Discharge Limit Exceedance

The laboratory analyzing samples from the separator will notify the terminal or its representative via telephone or e-mail if any sample result exceeds the established NPDES effluent limitations for oil and grease, total suspended solids, benzene, ethylbenzene, or zinc (see Table 1). If this occurs, the discharge should be closed (refer to Section 4.3), and a second sample should be collected and analyzed. If the second sample is within discharge limits, the discharge will be opened and the source of the exceedance investigated.

8.1.2 DAILY MONITORING

Flow	Rainfall at the terminal will be measured by reading the rain gauge. The rainfall will be recorded daily on the NPDES Monitoring Daily Log Form (Form ES-3). Flow will be estimated from the daily rainfall measurements. The flow will be calculated and entered on the Discharge Monitoring Report each quarter.
Oil & Grease Visual Inspection	The clearwell at the end of the main oil/water separator and the sampling port in the third compartment of the small oil/water separator will be inspected for visible sheen. The date, time, inspector's initials, and whether or not sheen was observed will be recorded on the NPDES Monitoring Daily Log Form (Form ES-3).
pH Grab Sample	A grab sample will be collected from the main separator clearwell using a disposable polyethylene bailer. Some

of the sample will be transferred to a clean jar. A pH measurement will be taken by using either pH paper or a pH probe. The probe will be calibrated before each use and cleaned at least weekly. The date, the time, the results, and the sampler's initials will be recorded on the NPDES Monitoring Daily Log Form (Form ES-3).

8.1.3 MONTHLY MONITORING

All sampling will be conducted during discharge to the storm sewer. DISCHARGE is defined as measurable flow through the outlet of the separator. If there is no measurable flow during the entire month, then zero flow will be noted on the NPDES Monitoring Daily Log Form (Form ES-3), and no sample will be collected. Samples will be collected as early as possible each month (week 1) so that results from the laboratory will be received in a timely manner for reporting to Ecology.

Oil & Grease

Samples will be collected from the main separator clearwell and the sampling port in third compartment of the small separator using a disposable polyethylene bailer. The containers will be filled as outlined in Table 2. The sample number, the date, the time, the laboratory parameter, the laboratory method, and the sampler initials will be recorded on the chain-of-custody form.

Total Petroleum Hydrocarbons and BTEX

Samples will be collected from the main separator clearwell using a disposable polyethylene bailer. The containers will be filled as outlined in Table 2. The sample number, the date, the time, the laboratory parameter, the laboratory method, and the sampler initials will be recorded on the chain-of-custody form. BTEX samples will be submitted on a 24-hour turnaround time basis.

Total Zinc, Total Lead, and Total Copper

Samples will be collected from the main separator clearwell by using a disposable polyethylene bailer. The containers will be filled as outlined in Table 2. The sample number, the date, the time, the laboratory parameter, the laboratory method, and the sampler initials will be recorded on the chain-of-custody form.

Total Suspended Solids	Samples will be collected from the main separator clearwell using an autosampler. The containers will be filled as outlined in Table 2. This sample will be an 8-hour composite consisting of four equal volume grab samples collected at 2-hour intervals (i.e., a 1 liter composite sample would contain four 250-milliliter grab samples). The sample number, the date, the time, the laboratory parameter, the laboratory method, and the sampler's initials will be recorded on the chain-of-custody form.

8.1.4 ANNUAL MONITORING

Samples will be collected annually from the main separator clearwell and submitted to a laboratory for priority pollutant analysis. Samples will be collected during discharge (measurable flow through the outlet of the main separator) to the storm sewer. A disposable polyethylene bailer will be used to collect the samples. The containers will be filled for priority pollutant analyses as outlined in Table 2. Priority pollutant analyses include volatile organics, semivolatile organics, PCBs/pesticides, metals (total arsenic, cadmium, copper, lead, mercury, nickel, silver, and zinc), and cyanide. The sample number, the date, the time, the laboratory parameter, the laboratory method, and the sampler's initials will be recorded on the chain-of-custody form.

8.2 Sample Storage and Shipment

A sample label must be filled out for all samples going to the laboratory. This information will be filled out using waterproof ink. The label will identify, at a minimum, the following information:

- Sample number (including month designation)
- Analyses to be performed
- Preservative added
- Sampler's name
- Date
- Facility's name

A chain-of-custody will be completed for each set of samples to be submitted to the laboratory for analyses. Standard laboratory analysis turn-around will be required for all analyses except for BTEX. The 24-hour turn-around will be clearly identified as a "special requirement" on the chain-of-custody for BTEX analyses. The sampler will retain one copy for the terminal's records. The signed form will be placed in a sealed plastic bag and taped to the inside lid of the cooler.

The sampler will pack the sample bottles in a cooler, using ice or blue ice to maintain cool temperatures (4°C) during transport. The bottles will be packed to ensure that breakage does not occur (e.g., cushioned with Styrofoam peanuts).

The sampler will deliver the samples directly to the laboratory upon completion of sampling, or the samples will be shipped via Federal Express. If samples are temporarily stored before they are driven to the laboratory or shipped, a custody seal will be affixed to the outside of the cooler and positioned so that the seal will break if the cooler is opened.

The samples must be transported to the laboratory in a timely manner so that analyses can be performed by the holding times outlined for the respective parameters in Table 2.

8.3 Reporting Requirements

For each measurement or sample taken, the following information must be recorded:

- The date, exact place (i.e., clearwell), method, and time of sampling
- The dates the analyses (if applicable) were performed
- Who performed the sampling and analyses
- The laboratory techniques or methods used
- The results of the analyses or monitoring

Monitoring results will be summarized and reported on a quarterly basis for monitoring results obtained during the previous three months.

The results will be submitted on a discharge monitoring report (DMR) form. With respect to visual inspection, the DMR will be filled out as follows:

- Circle the "yes" when visual sheen is observed during discharge conditions (i.e., measurable flow).
- Circle the "no" when no visual sheen is observed or when visual sheen is observed during "no discharge" conditions.

All DMRs will be checked for accuracy and to determine whether an apparent exceedance of effluent limits resulted from laboratory error, upsets, or other unusual or nonrepresentative conditions. Such circumstances must be noted on the DMR and/or further explained in an accompanying letter.

The DMR will be submitted to Ecology no later than the 15th day of the month following the completed reporting period.

TABLES

Table 1

Effluent Limitations
NPDES Waste Discharge Permit No. WA-000179-1
Shell Seattle Distribution Terminal

Parameter	Average Monthly[a]	Maximum Daily[b]
Main Oil/Water Separator (Outfall 001)		
pH	Between the range of 6.5 and 8.5 standard units	
Oil and Grease	10 mg/L	15 mg/L
Oil and Grease	No oily sheen	
Total Suspended Solids (TSS)	21 mg/L	33 mg/L
Benzene	——	71 µg/L
Ethylbenzene	——	100 µg/L
Total Zinc	——	1,138 µg/L (prior to 2/1/06)[c]
Total Zinc	——	95 µg/L (effective 2/1/06)[c]
Small Oil/Water Separator (Outfall 002)		
Oil and Grease	10 mg/L	15 mg/L
Oil and Grease	No oily sheen	

Notes

—— = effluent limitation not available

[a] The average monthly effluent limitation is defined as the highest allowable average of daily discharges over a calendar month, calculated as the sum of all daily discharges measured during a calendar month divided by the number of daily discharges measured during that month. If only one sample is taken during the calendar month, the maximum daily effluent limitation applies to that sample.

[b] The maximum daily effluent limitation is defined as the highest allowable daily discharge.

[c] The interim effluent limitation for zinc is 1,138 µg/L. The final effluent limitation is the acute marine water quality criterion for zinc (95 µg/L), effective February 1, 2006.

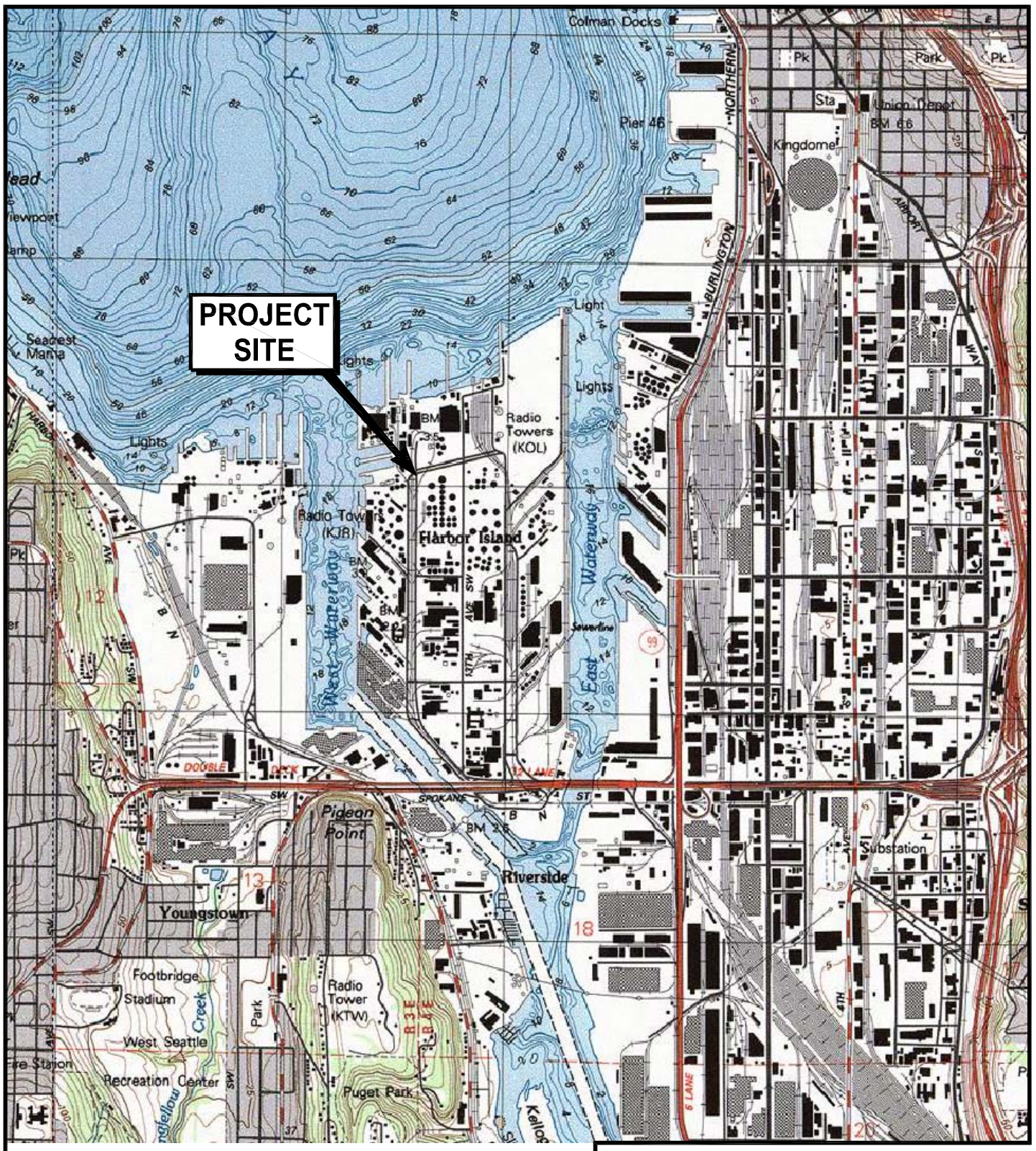
Table 2

Summary of Analytical Methods, Containers, Preservatives, and Holding Times for Water Analyses
Shell Seattle Distribution Terminal

Analytical Parameter	Analytical Method	Sample Type	Container	Preservation & Handling [a]	Holding Time
Oil & Grease	1664	Grab	1-L amber glass bottle; PTFE-lined cap	HCL to pH <2. Keep on ice (4°C).	28 days
TPH-G	NWTPH-Gx	Grab	(2) 40 mL glass vial; PTFE-lined silicon septum cap	HCL to pH <2. Fill leaving no air space. Keep in dark on ice (4°C).	14 days
Benzene, toluene, ethylbenzene, xylenes	8021	Grab	(2) 40 mL glass vial; PTFE-lined silicon septum cap	HCL to pH <2. Fill leaving no air space. Keep in dark on ice (4°C).	14 days
Total Suspended Solids	160.2	8-hour composite, 4 equal volume aliquots, 2-hour intervals each	1-L high density, polyethylene bottle; PTFE-lined cap	No preservative. Keep on ice (4°C).	7 days
Volatile Organics	624	Grab	(3) 40 mL glass vial; PTFE-lined silicon septum cap	HCL to pH <2. Fill leaving no air space. Keep in dark on ice (4°C).	14 days
Semivolatile Organics	625	Grab	1-L amber glass bottle; PTFE-lined cap	No preservative. Keep on ice (4°C).	7 days
PCBs/pesticides	608	Grab	1-L amber glass bottle; PTFE-lined cap	No preservative. Keep on ice (4°C).	7 days
Metals (As, Cd, Cu, Pb, Hg, Ni, Ag, Zn)	200 (200.7 for copper, lead, and zinc)	Grab	0.5-L high density polyethylene bottle; PTFE lined cap	HNO_3 to pH <2. Keep on ice (4°C).	28 days
Cyanide	335.2	Grab	l-L high density polyethylene bottle; PTFE-lined cap	Na0H to pH >12. Keep on ice (4°C).	14 days

[a] Preservative will be added to the bottles by the laboratory before shipment of bottles to the Terminal.

FIGURES



0 2000 4000

Scale in Feet

N

U.S.G.S. Topo Maps - Seattle South W and Seattle South E, Washington, 7.5-minute quadrangles.1978 photorevised 1983.

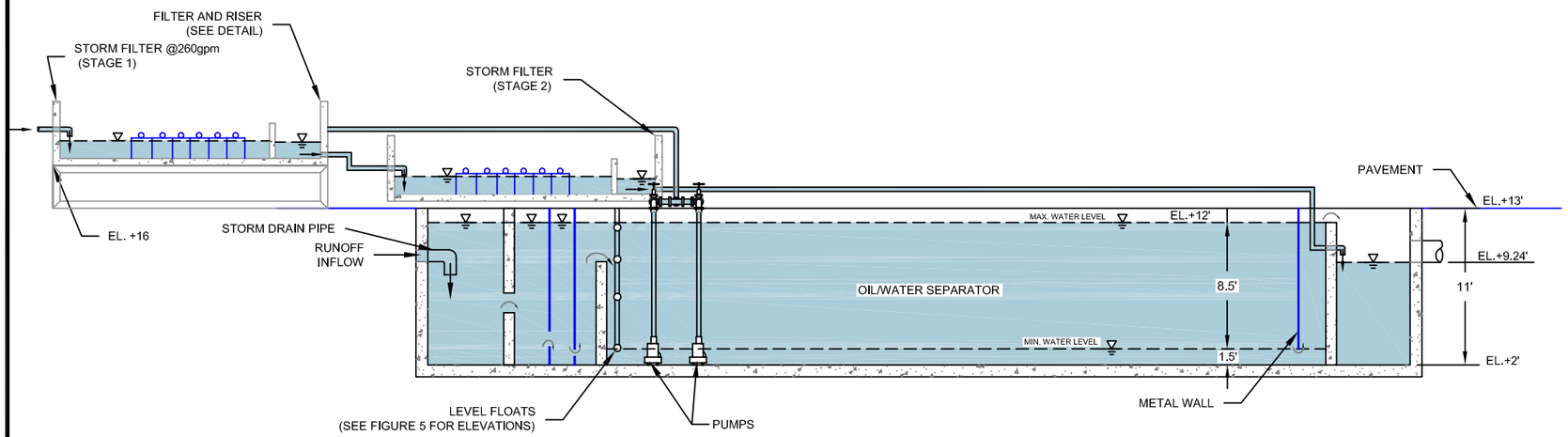
PES Environmental, Inc.
Engineering & Environmental Services

Site Location Map
Shell Seattle
Distribution Terminal
Seattle, Washington

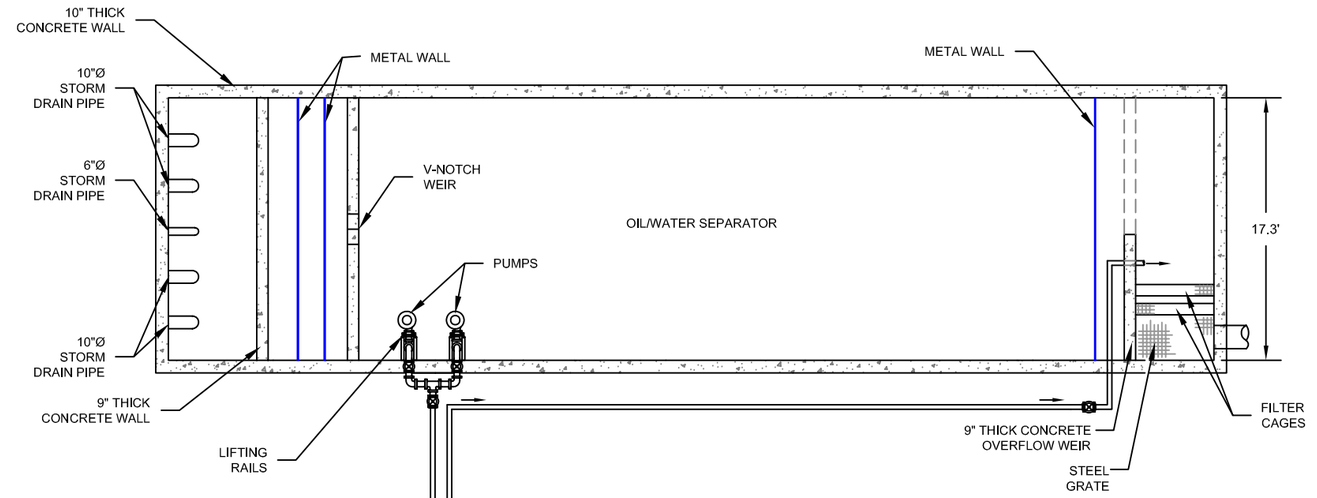
FIGURE
1

828.001.03.001	828_OM_equilon		12/05
JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE

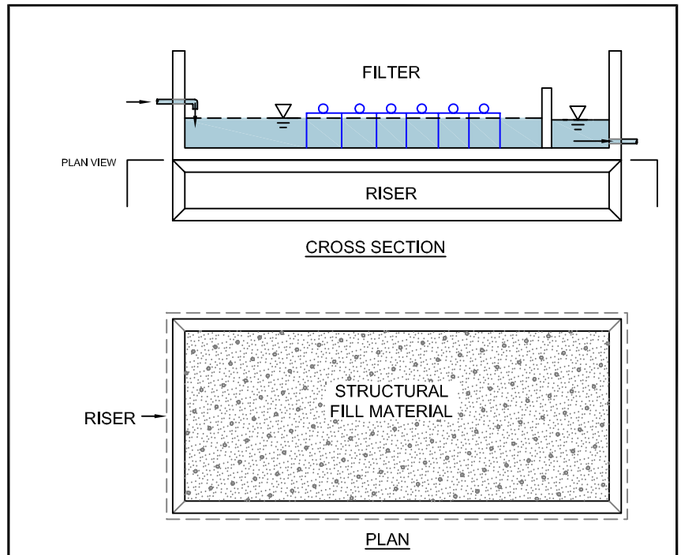
HI-SHELL001788



CROSS SECTION



PLAN VIEW



FILTER AND RISER DETAIL

N

0 10

SCALE IN FEET

TOTAL SURGE CAPACITY

-OWS (at EL +12')	= 58,000 gal.*
-STORM DRAIN	= 11,000 gal.
-ON SITE PONDING	= 20,000 gal.
	89,000 gal.

*(WITH 1ft CONSTANT WATER AT OWS)

SOURCE: Retec (2005)

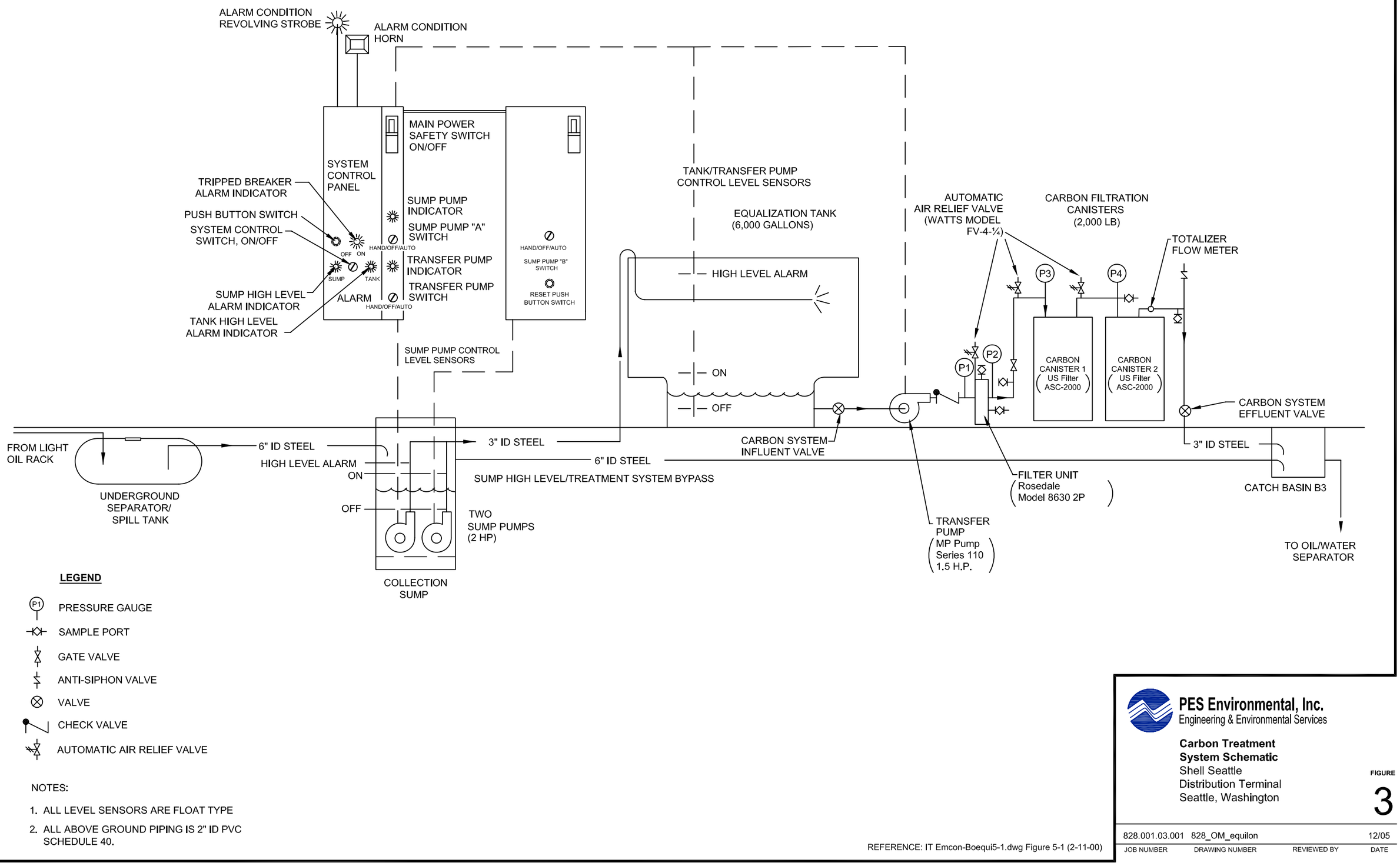
PES Environmental, Inc.
Engineering & Environmental Services

Stormwater Treatment System Layout with Pump Station
Shell Seattle
Distribution Terminal
Seattle, Washington

FIGURE
2

828.001.03.004	828_OM_D-80009		12/05
JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE

HI-SHELL001789



LEGEND

- P1 PRESSURE GAUGE
- SAMPLE PORT
- GATE VALVE
- ANTI-SIPHON VALVE
- VALVE
- CHECK VALVE
- AUTOMATIC AIR RELIEF VALVE

NOTES:

1. ALL LEVEL SENSORS ARE FLOAT TYPE
2. ALL ABOVE GROUND PIPING IS 2" ID PVC SCHEDULE 40.

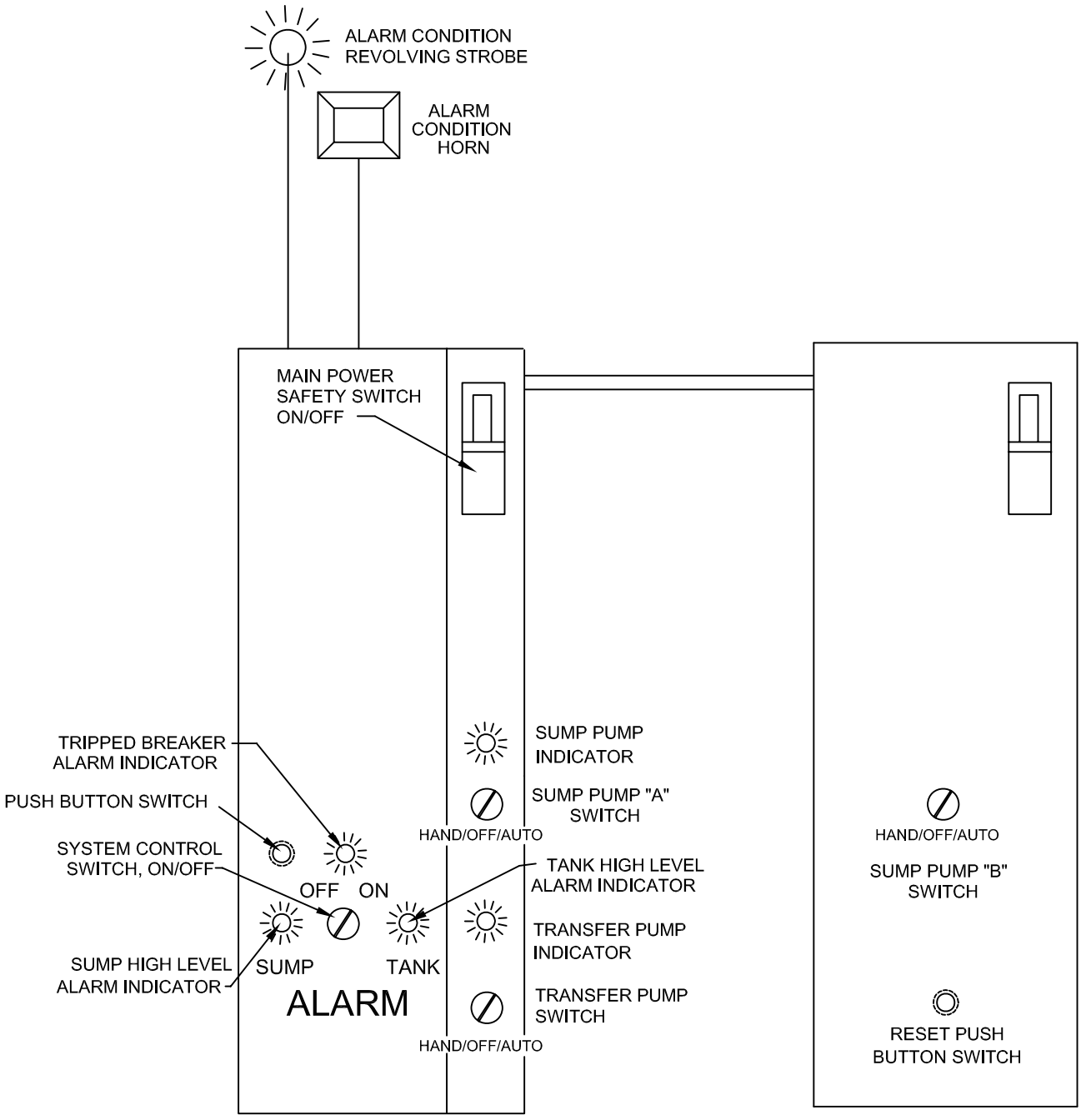
REFERENCE: IT Emcon-Boequi5-1.dwg Figure 5-1 (2-11-00)

PES Environmental, Inc.
Engineering & Environmental Services

Carbon Treatment System Schematic
Shell Seattle
Distribution Terminal
Seattle, Washington

FIGURE 3

828.001.03.001	828_OM_equilon		12/05
JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE



REFERENCE: IT Emcon-Boequi5-2.dwg Figure 5-2 (6-21-00)

PES Environmental, Inc.
Engineering & Environmental Services

Carbon Treatment System
Control Panels
Shell Seattle
Distribution Terminal
Seattle, Washington

FIGURE
4

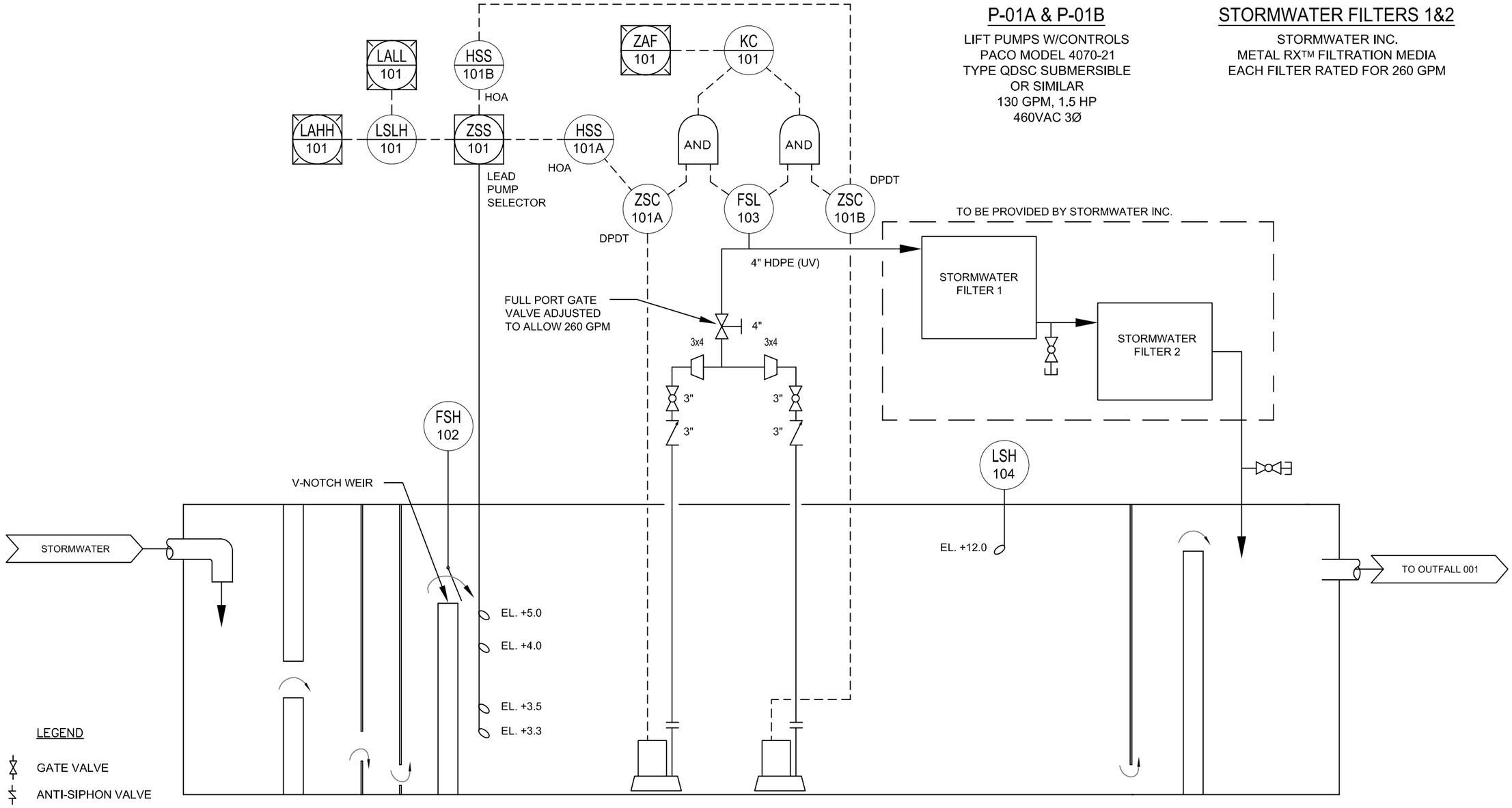
828.001.03.004	828_OM_equilon		12/05
JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE

P-01A & P-01B

LIFT PUMPS W/CONTROLS
PACO MODEL 4070-21
TYPE QDSC SUBMERSIBLE
OR SIMILAR
130 GPM, 1.5 HP
460VAC 3Ø

STORMWATER FILTERS 1&2

STORMWATER INC.
METAL RX™ FILTRATION MEDIA
EACH FILTER RATED FOR 260 GPM



LEGEND

- GATE VALVE
- ANTI-SIPHON VALVE
- REDUCING BUSHING

P-01A & P-01B
LIFT STATION IN CENTRAL
COMPARTMENT OF OWS

FSH-102	INFLUENT HIGH FLOW SWITCH
LSLH-101	FOUR-POINT LEVEL SWITCH TREE
LAHH-101	HIGH SUMP WARNING LIGHT
LALL-101	LOW LEVEL ALARM LIGHT
ZSS-101	PUMP SELECTOR RELAY
HSS-101A/B	LIFT PUMP SELECTOR SWITCHES
ZAF-101	FAULT WARNING LIGHT
KC-101	PUMP RUN TIMER
ZSC-101A/B	PUMP AUXILLIARY CONTACT
FSL-103	PUMP EFFLUENT LOW FLOW SWITCH
LSH-104	HIGH LEVEL SWITCH

SOURCE: Retec (2005)

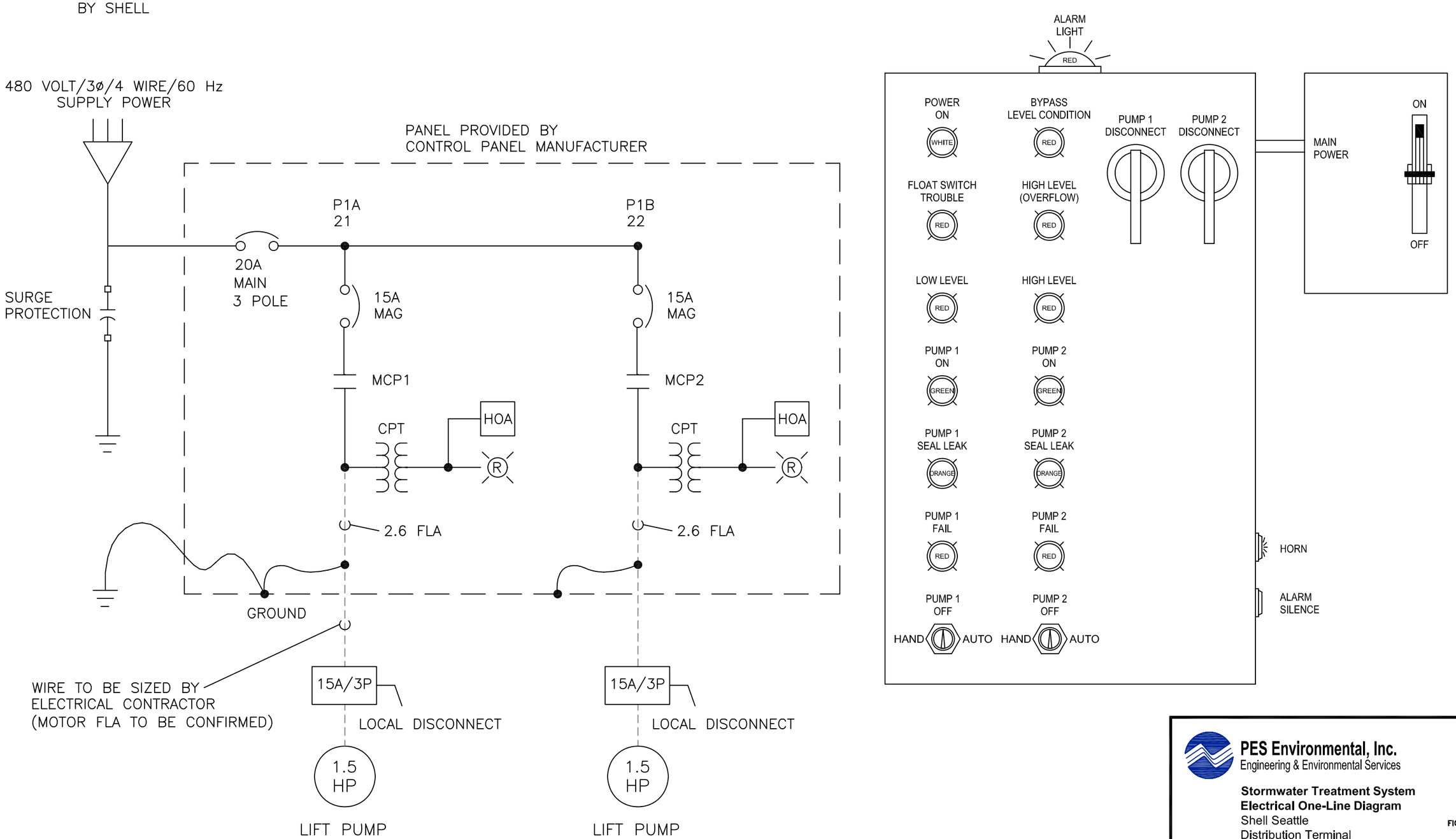
PES Environmental, Inc.
Engineering & Environmental Services

Stormwater Treatment System
Piping and Instrumentation Schematic
Shell Seattle
Distribution Terminal
Seattle, Washington

FIGURE
5

828.001.03.001	828_OM_D-80010		12/05
JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE

LOCAL POWER SUPPLY TO BE PROVIDED BY SHELL



SOURCE: Retec (2005)

PES Environmental, Inc.
Engineering & Environmental Services

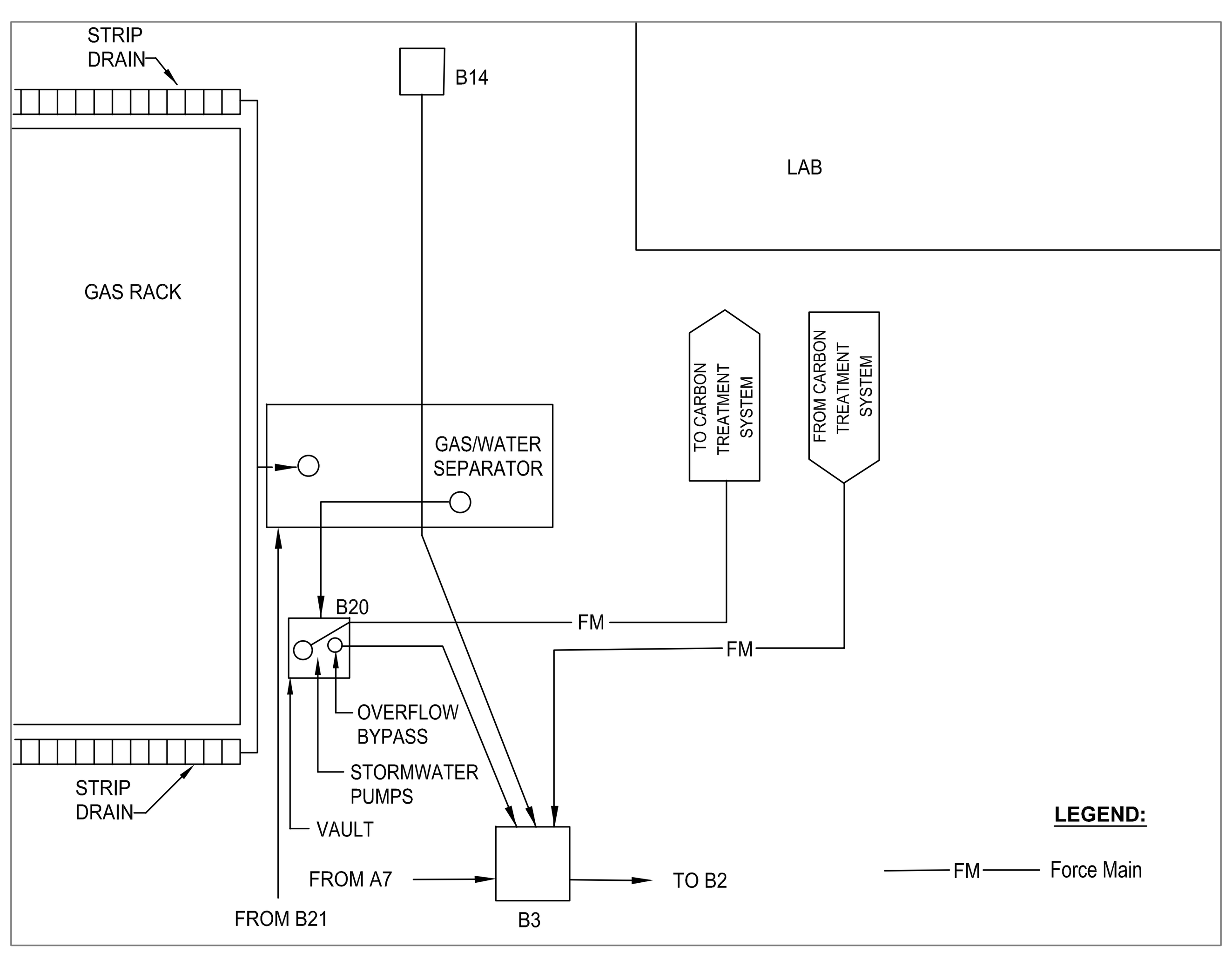
Stormwater Treatment System
Electrical One-Line Diagram
Shell Seattle
Distribution Terminal
Seattle, Washington

FIGURE
6

828.001.03.001	828_OM_D-80011		12/05
JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE

HI-SHELL001793

DRAWING



CARBON TREATMENT SYSTEM

DETAIL 1
N.T.S.

LEGEND:

- 80001 Tank and Number
- Property Line
- Fence
- Fire Wall or Containment Wall
- D.S. Roof Drain Downspout
- A7 Catch Basin
- Drain
- Railroad Track
- (A) Drainage Basin I.D.
- Containment Drain Valve
- Aboveground Pipelines
- Aboveground Pipelines
- Underground Pipelines
- Storm Drain
- Sanitary Sewer
- Approximate Drainage Basin Boundary
- Gravel Surface
- Asphalt Concrete Pavement
- Concrete Pad

NOTE: The drainage system shown in this drawing is for informational use only and is not based on a survey. The location of the drainage system is approximate and is based on drawings provided by Equilon (formerly Texaco), selective dye and/or hydraulic testing and IT Corporation's (formerly EMCON) best understanding of the site conditions at the time.

N

0 50
SCALE IN FEET

REFERENCE: IT Emcon-BO-EQUI-SHT1.dwg Sheet 1 (9-01)

PES Environmental, Inc.
Engineering & Environmental Services

Drainage Map
Shell Seattle
Distribution Terminal
Seattle, Washington

DRAWING
1

828.001.03.004	828_OM_equilon		12/05
JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE

APPENDIX A

FORMS

FORM ES-1

DIKE DRAIN REPORT
SEATTLE

Date:

Area: Main Tank Farm

Types of product stored within the dike: Gasolines, Distillates, Additives

Dike drain Inspected by:	**Time dike drain Valve opened:**	**Time dike drain Valve closed:**

Contamination found? _____ Yes _____ No _____ Date & Time

Water sample taken? _____ Yes _____ No _____ Date & Time

Results received? _____ Yes _____ No _____ Date & Time

Comments: _____

Supervisor Signature:

**** MANAGEMENT APPROVAL NEEDED BEFORE OPENING ANY VALVES ****

FORM ES-2

QUARTERLY DIKE DRAIN INSPECTION
SEATTLE

DATE: _____

DRAIN VALVE #: _____

1. Valve locked?	_____	Yes	_____	No	_____ Need a lock
2. Does valve operate easily?	_____	Yes	_____	No	_____ Needs lubrication
3. Valve inlet free of debris?	_____	Yes	_____	No	_____ Needs cleaning
4. Valve inlet free of silt?	_____	Yes	_____	No	_____ Needs removal
5. Paint condition?	_____	Good	_____	Fair	_____ Needs painting

Any other condition that needs attention or work to ensure a clean and safe dike draining operation?

_____

_____

_____

_____

Supervisor Signature: _____

FORM ES-3

SHELL SEATTLE TERMINAL - NPDES MONITORING

DAILY LOG FORM Month: _____ Year: _____

See reverse side for notes

		MAIN SEPARATOR							SMALL SEPARATOR			
Day	Time	Sheen Observed in Last Bay? (circle one) (Note 1)	pH upstream of Calcium (Note 2)	pH at Outfall (6.5 - 8.5) (Note 3)	Temp	Flow (y / n)	Rain Gauge (Note 4)	Rain pH (weekly)	Visual Appearance (Note 5)	pH (monthly)	Sampler's Initials (Note 6)	Daily Carbon System Check (Note 7)
1		yes / no										
2		yes / no										
3		yes / no						See				
4		yes / no						table				
5		yes / no						below				
6		yes / no										
7		yes / no										
8		yes / no										
9		yes / no										
10		yes / no						See				
11		yes / no						table				
12		yes / no						below				
13		yes / no										
14		yes / no										
15		yes / no										
16		yes / no										
17		yes / no						See				
18		yes / no						table				
19		yes / no						below				
20		yes / no										
21		yes / no										
22		yes / no										
23		yes / no										
24		yes / no						See				
25		yes / no						table				
26		yes / no						below				
27		yes / no										
28		yes / no										
29		yes / no										
30		yes / no										
31		yes / no										

Spill Containment Tank (Note 8)	**Week 1- Date:**	**Wk 2- Date:**	**Wk 3- Date:**	**Wk 4 - Date:**
1. Total Liquid Height =	(in)	(in)	(in)	(in)
2. Height of Water =	(in)	(in)	(in)	(in)
3. Product Thickness (#1-#2)=	(in)	(in)	(in)	(in)
4. Was Product Transferred?	Yes / No	Yes / No	Yes / No	Yes / No

See reverse side for notes.

Week 5 - Date:			
1. Liquid Height =	(in)	3. Product Thickness =	(in)
2. Height of Water =	(in)	4. Was Product Transferred?	Y / N

NOTES:

1 Main Outfall - Visual Appearance: Check the last bay for oil, sheen, discoloration or abnormal conditions. If sheen is observed in the last bay, circle "yes," and immediately notify the Operations Supervisor or Terminal Manager to take corrective actions. If no sheen is observed, circle "no." Check the entire separator for abnormal conditions and to determine if absorbent pads or booms need to be replaced. Notify the Operations Supervisor or Terminal Manager in the event of any abnormal conditions.

2 Upstream pH: Take a pH reading daily at the pre-designated point, a distance upstream from the calcium carbonate rocks. This reading is for information only and will be compared to the pH reading at the Outfall (which is downstream of the calcium carbonate.) The purpose of the calcium carbonate rocks is to increase the pH of the discharge water, to ensure it meets the lower limit of 6.5. Taking readings both upstream and downstream is a quality control measure to make sure the calcium is functioning properly.

3 Outfall pH: This pH reading is required by the permit and shall be taken at the designated Outfall sampling point in the very last compartment (clear well) of the separator. The operator should be aware of the following two things:

First, the permit requires the pH at the Outfall to be no less than 6.5

Second, the pH at the Outfall should generally be higher than the pH upstream, because this is how the calcium carbonate works. Sometimes, if the pH is very close to 7.0, there may be a 0.1 difference either way between the two readings. However, for pH in the mid-6 range, the Outfall (downstream) reading should be higher than the upstream pH.

*** If either of these conditions is NOT the case, the operator should do the following: Retake the pH readings at both the Outfall and upstream of the calcium carbonate. If the situation still exists, clean and recalibrate the pH meter and retake both readings. If the situation continues, notify the Operations Supervisor or Terminal Manager to contact PES Environmental to assist with additional readings using a different meter and to check the calcium carbonate for proper functioning (may require cleaning or replacement of the rocks.) If the situation cannot be resolved, and the Outfall pH is less than 6.5, notify the Department of Ecology and the Shell Environmental Support Group.

4 Rain Gauge: Check weekly to make sure that the rain gauge is in an upright position and that nothing is blocking the top of the rain gauge.

5 Small Separator - Visual Appearance: Check 1st and 2nd bays for heavy oil accumulation; check final bay for oil accumulation; check discharge for oil sheen.

6 **If any unusual condition is observed, sampler should immediately notify the Operations Supervisor or Terminal Manager.**

7 Carbon System - Daily Check:
(a) Main power switch should be in the "on" position
(b) System control switch should be in the "on" position
(c) Sump pump and transfer pump switches should be in the "auto" position
(d) Sump high-level and tank high-level alarm lights should not be on.

8 Spill Containment Tank - Weekly Check:
(a) Gauge product thickness and record all data in inches
(b) Indicate if product was transferred from the tank by circling "yes" or "no" as applicable

FORM ES-4

SHELL SEATTLE TERMINAL
LIGHT OIL FUEL RACK
CARBON TREATMENT SYSTEM INSPECTION LOG

System Component	Status[1]	Hand Test[2]	Comments/Recommendations
Main Power Switch (On)			
Pump Switch Lights		—	
Sump High Level Alarm Light		—	
Eq. Tank High Level Alarm Light		—	
Sump Pump "A" Switch (Auto)			
Sump Pump "B" Switch (Auto)			
Sump Pump Level Switches			
Equalization Tank[3] (Inches to Empty-ITE)			
Transfer Pump Switch (Auto)			
Filter Influent Pressure (P1)			
Filter Effluent Pressure (P2)			
Carbon 1 Influent Pressure (P3)			
Carbon 2 Influent Pressure (P4)			
Tank Effluent Valve Position	___ turns open	(____ turns is full open)	
Carbon Influent Valve Position	___ turns open	(____ turns is full open)	
Carbon Effluent Flow Rate[4]			
Number of spare particulate filters		—	

Inspector:_____ Date:_____

Notes

1. Document alarm light status, control switch positions, pressure gauge readings, and component breakage/malfunction.
2. Hand test all pumps by verifying operation when turning the control switch to "hand". Hand test collection level switches by manually activation.
3. Monitor proper operation of equalization tank level switches during high flow events.
4. Monitor totalizer for 1 - 2 minutes of operation to document carbon effluent flow rate.

APPENDIX B

CARBON SYSTEM SPECIFICATIONS

ASC-1200/2000

INSTALLATION AND START UP INSTRUCTIONS

IMPORTANT: Read all instructions prior to start-up.

AQUA-SCRUB's have been designed for easy and rapid installation. Final installation requires the connection of the AQUA-SCRUB to the process outlet through the use of suitable pipes, ducts, or flexible hoses. The following instructions must be followed prior to system start-up.

1. Place the AQUA-SCRUB unit in an area close to the problem water or leachate source, and accessible to maintenance personnel. The AQUA-SCRUB is self supporting and therefore requires no special stand or support pad. The area chosen for locating the AQUA-SCRUB unit should be level, flat and capable of supporting its weight.

2. Remove AQUA-SCRUB's protective shipping plugs and save for later transportation.

3. Using the fitting labelled "outlet", fill the AQUA-SCRUB with water or the liquid to be treated and allow to soak for a minimum of 24 hours. Before beginning continuous operation, backflush the AQUA-SCRUB 1200 at a rate of 25-30 gpm using 3 bed volumes of water (~ 1000 gallons). Backflushing will require from 30-40 minutes to complete depending on water flow rate. For an AQUA-SCRUB 2000, backflush at a rate of 25-30 gpm using 3 bed volumes of water (~ 1600 gallons). Backflushing will require 50-60 minutes to complete depending on water flow rate.

4. Westates Carbon, Inc. strongly suggest that the completed installation include a pressure relief valve and a particulate filter as shown on the enclosed diagram. For information regarding these devices, please call your Westates sales representative.

5. The inlet of the AQUA-SCRUB should be connected to the outlet of the stream to be treated using suitable piping with a flex connection or flexible hose.

   C A U T I O N: AQUA-SCRUB's are designed for maximum pressure of 12 psig.

6. The AQUA-SCRUB system is designed for continuous use with little or no maintenance. Occasional low flow-back-washing may be required to remove particulate build up on the carbon.

FOR ADDITIONAL INFORMATION PLEASE CONTACT:

WESTATES CARBON

LOS ANGELES, CA. (213) 722-7500
OAKLAND, CA. (415) 639-7274
CINCINNATTI, OH. (513) 874-1777
HOUSTON, TX. (713) 333-9488
HUNTINGTON, NY. (516) 427-2300

AQUA-SCRUB

ASC-1200/2000

INSTALLATION AND START UP INSTRUCTIONS

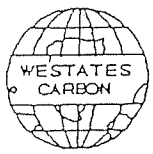
IMPORTANT: Read all instructions prior to start-up.

CONNECTION SIZES		
MODEL NO. ASC-1200/ ASC-2000	SIZES	LOCATION
Inlet	2" FNPT	Top
Outlet	2" FNPT	Top

OPERATING CONDITIONS

	OPTIMUM	MAXIMUM
Water flow rate	0-50 gpm	50 gpm
Water temperature	77° F	120°
System pressure	0-12 psig	12 psig
Influent PH	5-7	3-11

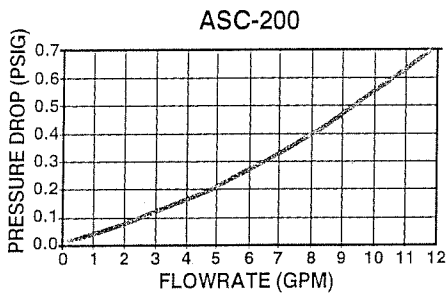
For Technical Assitance or Ordering Information call,

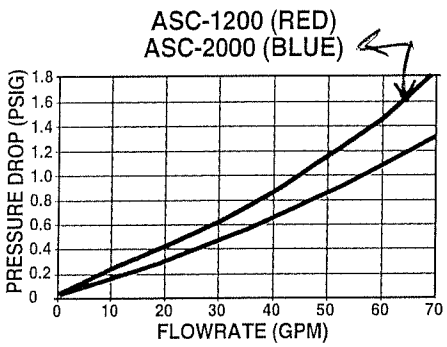


LOS ANGELES, CA. (213) 722-7500
OAKLAND, CA. (415) 639-7274
CINCINNATTI, OH. (513) 874-1777
HOUSTON, TX. (713) 333-9488
HUNTINGTON, NY. (516) 427-2300

AQUA-SCRUB™

WATER TREATMENT





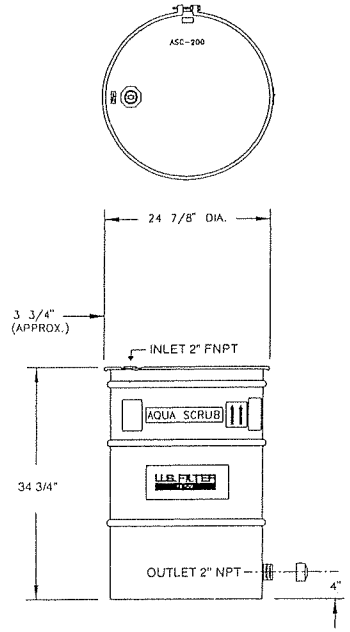
Vessel Specifications	ASC-200	ASC-1200	ASC-2000
Overall Height (approx.)	34-3/4"	62"	86"
Inlet/Outlet Connection	2"	4" FNPT	4" FNPT
Manhole	Top	16"	16"
Internal Piping	PVC	PVC	PVC
Interior Coating	Heat-cured	Fusion-bonded	Fusion-bonded
Liner	Phenolic Epoxy	Epoxy	Epoxy
Exterior Coating (all units)		Epoxy Urethane	Epoxy Urethane
Carbon Fill Volume (cu.ft.)	6.9	35	62
Cross Section (sq.ft.)	2.8	11.2	11.2
Vessel Weight (lbs.):			
Shipping (with KG-401 carbon)	250	1620	2540
Operating (approx.)	500	3500	5600

Operating Specifications	ASC-200	ASC-1200	ASC-2000
Flow, gpm (max)	10	50	50
Pressure, psig (max.)	15	15	15
Temperature °F. (max.)	140°	140°	140°
Pounds of SKG-401			
Activated Carbon	200	1000	1800
Contact time @ max. flow/min:	5	5	9
Backflush rates (GPM)	5	25	25

Reactivation of Spent Carbon

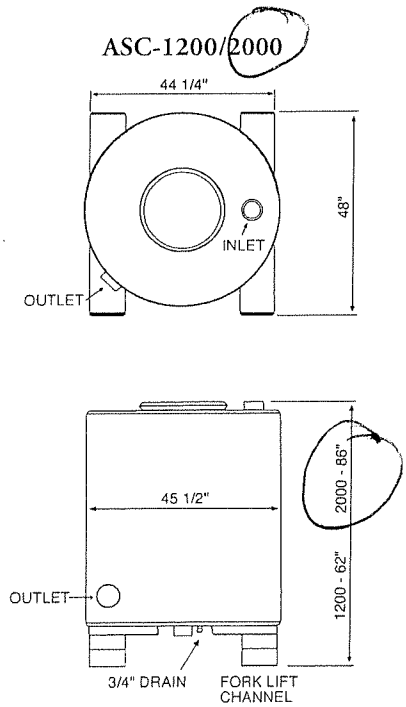
At the time of purchase or rental of the Aqua-Scrubs™, arrangements should be made for the reactivation of the spent carbon. U.S. Filter/Westates will provide instructions and assistance to obtain acceptance of the RCRA or non-RCRA spent carbon for reactivation. Aqua-Scrubs™ must be drained and the inlet/outlet plugged prior to shipment. Spent carbon cannot be received until the acceptance process has been completed.

ASC-200



Drawings not to scale

ASC-1200/2000

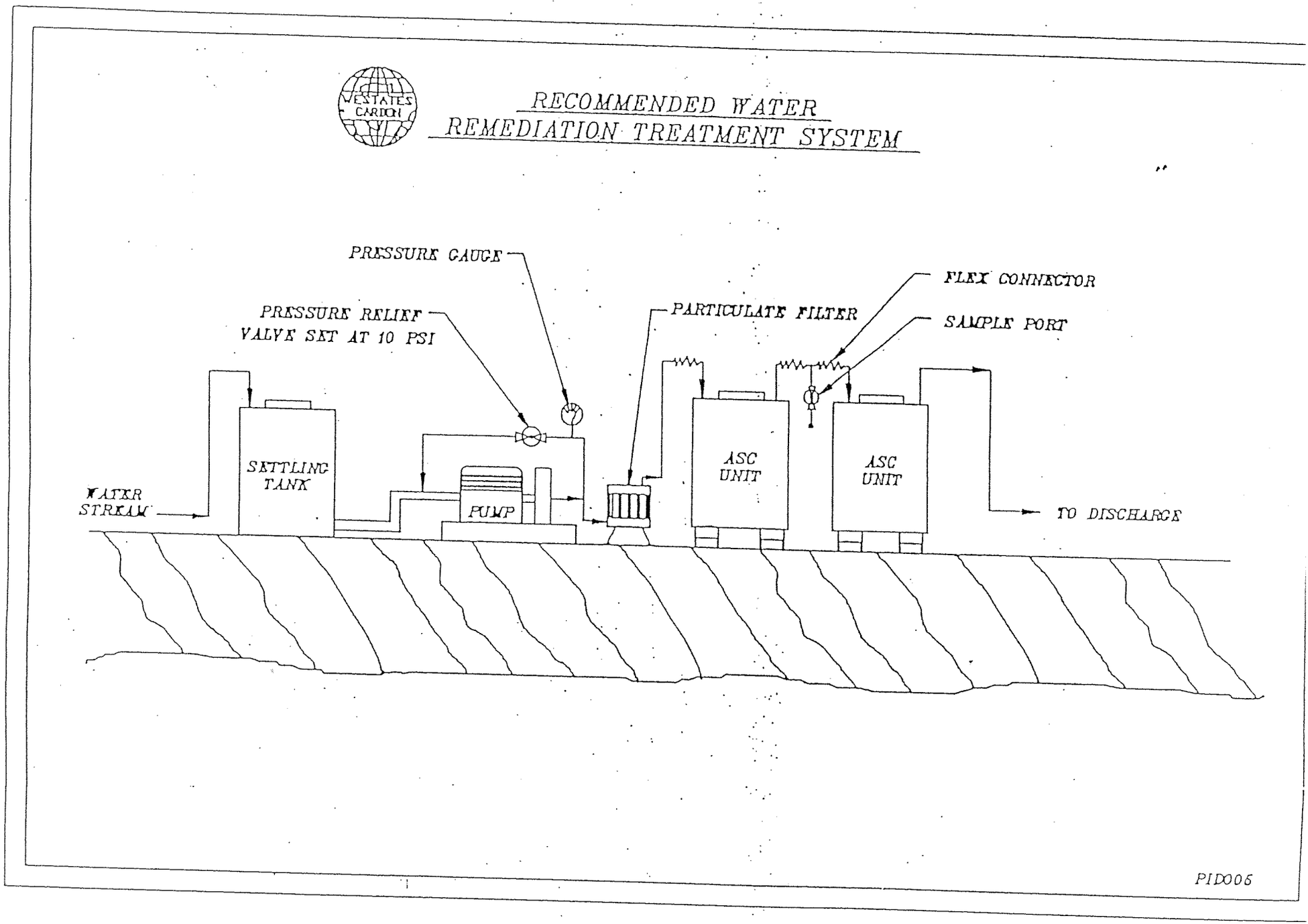


100% water

U.S. FILTER
WESTATES

Taking care of the world's water.

U.S.Filter/Westates
Baytown, TX 800-659-1723
Warren, NJ 800-659-1717
Los Angeles, CA 800-659-1771
Oakland, CA 800-659-1718


RECOMMENDED WATER
REMEDIATION TREATMENT SYSTEM
PRESSURE GAUGE
PRESSURE RELIEF
VALVE SET AT 10 PSI
PARTICULATE FILTER
FLEX CONNECTOR
SAMPLE PORT
SETTLING
TANK
WATER
STREAM
PUMP
ASC
UNIT
ASC
UNIT
TO DISCHARGE
PID006

SPENT CARBON PROFILE FORM

WESTATTER ARIZONA

r Office Use Only

ISR:	APPROVAL NO.:	VALID THROUGH:
OSR:		

A. GENERATOR INFORMATION

1.	Generator:		1A. Generator Fax:
2.	U.S. EPA ID NO.:	3. State ID NO.:	
4.	Generator Mailing Address:		
5.	Generator Mailing Contact:	6. Title:	7. Phone:
8.	Generator Site Address:		
9.	Generator Site Contact:	10. Title:	11. Phone:
12.	Consulting Firm & Address:		
13.	Consulting Firm Contact:	14. Title:	15. Phone:

B. PROPERTIES AND COMPOSITION

1. Specific & Descriptive Process Generating Waste (If additional space is needed, use Addendum "B"):

Type of Carbon: [ ] Liquid [ ] Vapor [ ] Pelletized [ ] Impregnated [ ] Mix | 3. Mesh Size: | 4. WCI Carbon NO [ ] YES [ ]

5. Chemical Composition: Below, list all constituents (including halogenated organics, lead, mercury) present in any concentration

CONSTITUENT:	CONCENTRATION:	UNIT/PPM:	CONSTITUENT:	CONCENTRATION:	UNIT/PPM:

6. Indicate analysis from: [ ] Influent Stream [ ] Spent Carbon

7. Is analysis attached? [ ] NO [ ] YES

8. Free Liquid Range For Aqua Phase carbon only: ( ) TO ( )

9. Strong Odor: [ ] NO [ ] YES Describe:

10. pH Range for liquid carbon only: ( ) TO ( ) [ ] N/A

11. Ignitable: [ ] NO [ ] YES Flashpoint:

12. Foreign Material: [ ] NO [ ] YES If yes, a sample must be sent to WCAI

14. Total carbon by volume or weight:

13. Other: [ ] None

[ ] PCB's, if yes concentration: [ ] DBCP

[ ] PYROPHORIC [ ] SHOCK SENSITIVE

[ ] EXPLOSIVE [ ] OXIDIZER

[ ] RADIO ACTIVE [ ] CARCINOGEN

[ ] INFECTIOUS [ ] METALS

15. No. of Filters:

Flow Rate:_____ [ ] GPM [ ] CFM

Service Duration between carbon changeouts:_____ No. of Months _____ Days used per month_____Hours used per day

18. Anticipated Spent Carbon Quantity Generated:_____ Volume or_____ lbs (Dry) per_____ (one time, wk, mo, yr.)

bbb.ONE
rv. 10-15-93

C.	CLASSIFICATION	
1.	Is this a U.S. EPA Hazardous Waste? [ ] NO [ ] YES	
2.	Identify all U.S. EPA characteristic and listed waste codes (D.F.K.P.U.):	
3.	Is this a Generator State Hazardous Waste [ ] NO [ ] Yes	4. Identify all Generator State Waste Codes:
5.	Is this waste subject to the Land Band [ ] NO [ ] Yes	

D.	SHIPPING INFORMATION	
1.	Packaging [ ] Bag [ ] Drum [ ] Roll-Off [ ] Slurry [ ] Other	
2.	Anticipated Annual Volume:	
3.	Shipping Frequency:	4. Amount/Shipment:

E. NOTES: Special requirements for personal protection equipment:
Please include MSDS if available. Available [ ] Not Available [ ]

F. GENERATOR'S CERTIFICATION

I hereby certify that all information on this and all attached documents contain true and accurate descriptions of this waste. Any analys submitted as hereby representative as defined in 40 CFR 261 - Appendix or by using an equivalent method. All relevant information regardi known or suspected hazards in the possession of the generator has been disclosed. I authorize Westates Carbon-Arizona, Inc. to obtain sample from any waste shipment for purposes of recertification.

SIGNATURE	PRINTED NAME	TITLE	DATE

Table.TWO.Rev.10-15-03

WESTATES CARBON-ARIZONA INC.

Addendum "B"

Spent Carbon Identification

G	
	Describe the Carbon treatment system and detail the source of, or process which created the contaminants that are on this carbon (examples; system filtering gasoline leaking underground storage tank, wastewater treatment for spent solvent used for degreasing printed circuit boards, ground water cleanup of spilled chemical from drum storage area, air filtration of office building, waste water treatment from a municipal sewage plant, etc.) Please feel free to draw a process flow diagram.

U.S. FILTER WESTATES

MATERIAL SAFETY DATA SHEET

SECTION I

Manufacturer: U.S. FILTER/WESTATES 2130 Leo Ave. Los Angeles, California 90040-1634	Product Name: ACTIVATED CARBON, CC SERIES, KG SERIES, KP SERIES MSDS: 100 CAS Number: CAS 7440-44-0 Date Prepared: JUNE 25, 1997 Prepared By: MARGARET JEFFERSON
Phone Number For Information: (213) 722-7500 Emergency Phone Number: (800) 659-1771	Note: Black spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that.

SECTION II - MATERIAL IDENTIFICATION AND INFORMATION

COMPONENTS - Chemical Name & Common Names (Hazardous Components 1% or greater; Carcinogens 0.1% or greater)	%	OSHA PEL	ACGIH TLV	OTHER LIMITS RECOMMENDED
ACTIVATED CARBON	100%	2.5mg/m^3	1.5mg/m^3	NONE
NON-HAZARDOUS INGREDIENTS				
TOTAL	100			

SECTION III - PHYSICAL / CHEMICAL CHARACTERISTICS

BOILING POINT: not applicable	SPECIFIC GRAVITY (H20 = 1): 0.25 - 0.60 g/cc
VAPOR PRESSURE (mm HG AND TEMPERATURE): zero	MELTING POINT: not applicable
VAPOR DENSITY (AIR = 1): not applicable	EVAPORATION RATE(_____ = 1): not applicable
SOLUBILITY IN WATER: Insoluble in water and solvents	WATER REACTIVE: non-reactive
APPEARANCE AND ODOR: Black granules without taste or odor	

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT AND METHOD USED: N/A	Auto-Ignition Temperature: > 450°C ANSI/ASTM D 3468	Flammability Limits in Air % by Volume: N/A	LEL N/A	UEL N/A

EXTINGUISHER MEDIA: Water (fog or fine spray), carbon dioxide

SPECIAL FIRE FIGHTING PROCEDURES: Avoid procedures that may stir up dust clouds.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Avoid contact with strong oxidizers.

SECTION V - REACTIVITY HAZARD DATA

STABILITY: Stable x Unstable ☐	CONDITIONS TO AVOID: Contact with strong oxidizers.
INCOMPATIBILITY (MATERIALS TO AVOID): Strong oxidizing agents	HAZARDOUS DECOMPOSITION PRODUCTS: Carbon Dioxide Carbon Monoxide
Hazardous polymerization: May Occur ☐ Will not Occur x	CONDITIONS TO AVOID: not applicable

SECTION VI - HEALTH HAZARD DATA

PRIMARY ROUTES: Inhalation x Ingestion ☐ CARCINOGEN LISTED IN: NTP ☐ OSSA ☐ LARC☐ Monograph ☐ Not Listed x

HEALTH HAZARDS LD50 VALVES: not available ACUTE: not available CHRONIC: No effects from chronic exposure are known

EMERGENCY FIRST AID PROCEDURES: Seek medical assistance for further treatment, observation and support if necessary.

EYE CONTACT: Immediately flush with copious amounts of water. If redness, itching or a burning sensation develops, have eyes examined and treated by medical personnel.

SKIN CONTACT: Wash material off the skin with soap and water. If redness, itching or a burning sensation develops, get medical attention

INHALATION: Remove victim to fresh air. If cough or other respiratory symptoms develop, consult medical personnel.

INGESTION: Give one or two glasses of water to drink. If gastrointestinal symptoms develop, consult medical personnel (Never give anything by mouth to an unconscious person).

SECTION VII CONTROL AND PROTECTIVE MEASURES

RESPIRATORY PROTECTION (SPECIFY TYPE): Use MSA-NIOSH approved respirator for respirable dusts, mists and fumes.

P[illegible]TECTIVE GLOVES: Rubber latex.

E[illegible] PROTECTION: Safety glasses with side shields. Contact lenses should not be worn when working with carbon.

VENTILATION TO BE USED: Local Exhaust x Mechanical (general) ☐ Special ☐ Other (specify) ☐

OTHER PROTECTIVE CLOTHING AND EQUIPMENT: NONE

HYGIENIC WORK PRACTICES: Wash contacted skin areas after handling.

SECTION VII - PRECAUTIONS FOR SAFE HANDLING AND USE/LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS SPILLED OR RELEASED: Wear respiratory protection during clean up. Sweep up and recover or mix material with moist absorbent for dust control and pick-up and shovel into waste container. Use detergent in spill area after clean up and flush with plenty of water.

WASTE DISPOSAL METHODS: Dispose of virgin (unused) carbon (waste or spillage) per local regulations.

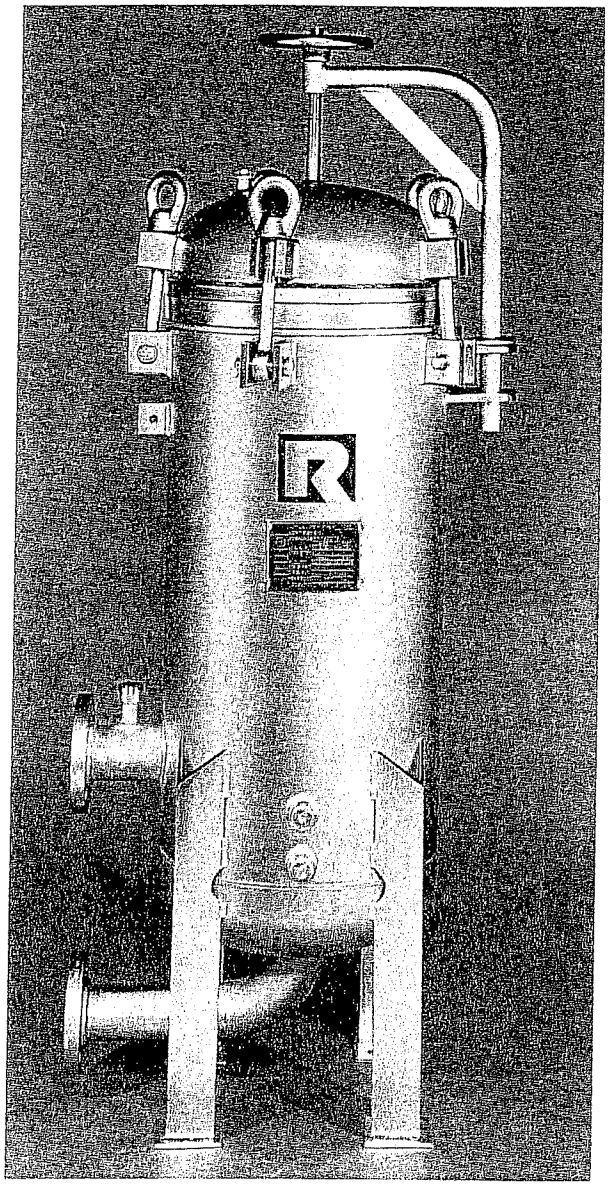
PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Activated carbon can be safely stored in any normal storage area, but away from direct heat.

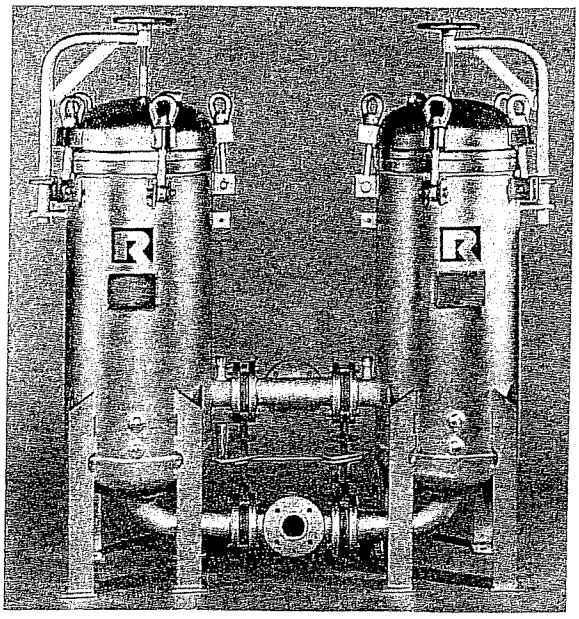
OTHER PRECAUTIONS AND OR SPECIAL HAZARDS: An oxygen deficiency may be created when activated carbon is stored in an enclosed space/silo. Ventilate or wear self-contained breathing apparatus. Follow procedures for confined space entry.

NFPA Rating: Health 1 Flammability 1 Reactivity 0	HMIS Rating: Health 1 Flammability 1 Reactivity 0 Special ☐

U.S. FILTER/WESTATES MAKES NO WARRANTIES, GUARANTEES OR REPRESENTATIONS OF ANY KIND OR NATURE WITH RESPECT TO THE PRODUCT OR THIS DATA, EITHER EXPRESSED OR IMPLIED, AND WHETHER ARISING BY LAW OR OTHERWISE, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF PERSONAL INJURY, PROPERTY OR OTHER DAMAGES OF ANY NATURE WHATSOEVER, WHETHER SPECIAL, INDIRECT, CONSEQUENTIAL OR COMPENSATORY, DIRECTLY OR INDIRECTLY RESULTING FROM THE PUBLICATION, USE OR RELIANCE UPON THIS DATA.

Cartridge Filter Housings





These cartridge filters offer a wide range of flow capacities and contaminant holding capabilities. The housing diameters can accommodate from 1 to 205 cartridges around.

All housings can be supplied with an ASME code stamp, if required.

STANDARD FEATURES

- Low pressure drop
- Permanently piped housings are opened without special tools and without disturbing the piping
- Machined cover gasket groove provides positive O-ring sealing
- Easy cleanability
- In-line inlet and outlet
- Stainless steel internals

STANDARD OPTIONS

- 2 outlet styles
- Carbon steel, 304, or 316 stainless steel housings
- ASME code stamp
- Five gasket materials: Buna N, Ethylene Propylene, Viton, Teflon encapsulated Viton, solid white Teflon
- Accommodates 10, 20, 30 or 40-inch cartridges
- Flanged connections for 3/4 through 12-inch pipe
- V posts or threaded center posts
- Units accept DOE or 222 style cartridges

SPECIAL OPTIONS

- Sanitary fittings and construction
- Higher pressure ratings
- Housings of alloy steel
- Corrosion allowances
- Steam jackets
- Special outlet locations
- Optional cartridge sealing methods–226, NPT, etc
- High temperature gasket designs

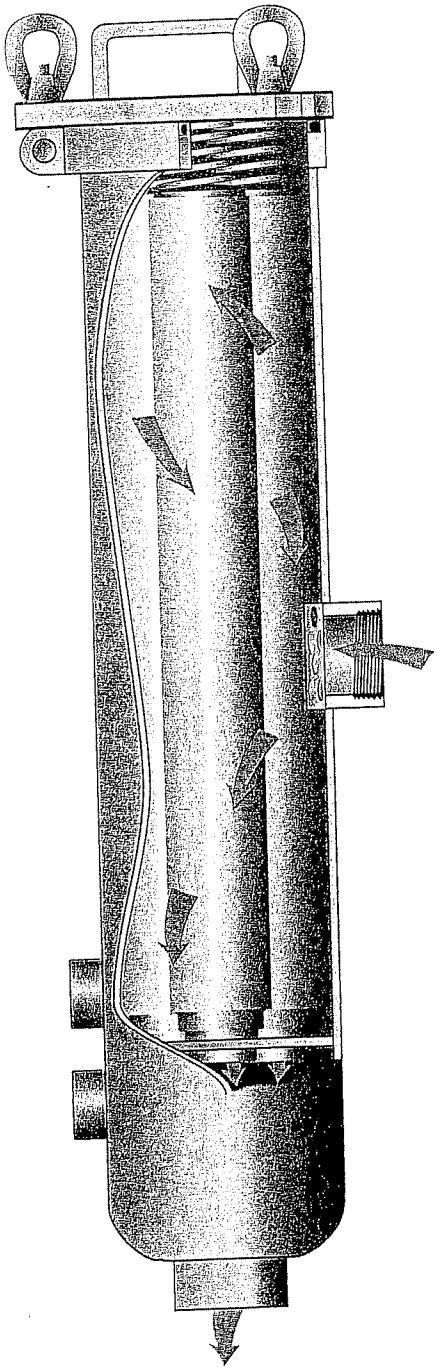
DUPLEX SYSTEMS

All cartridge filter models described here are also available as Duplex systems. Two units come piped together with valves to permit continuous use of either unit while servicing the other. One lever actuates all valves simultaneously.

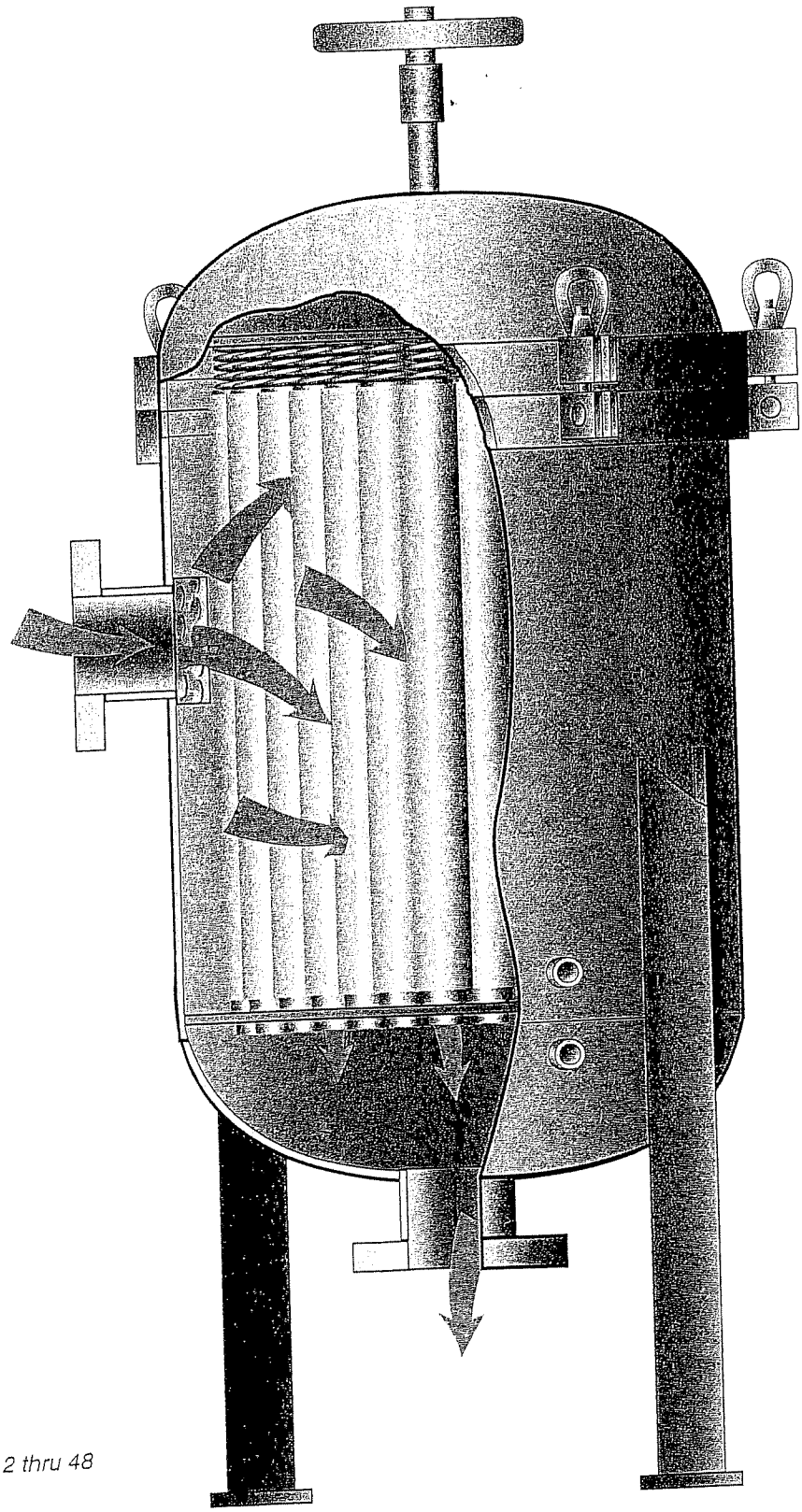
Ask for Catalog DF.

HOW THEY WORK

Unfiltered fluid enters the housing and is distributed evenly around the cartridges, from outside to inside. Solids are collected on the outside for easy removal The filtered fluid then exits through the outlet pipe.



Models 4, 6 and 8



Models 12 thru 48

CARTRIDGE REQUIREMENTS

The following table gives the number of cartridges needed for each housing model.

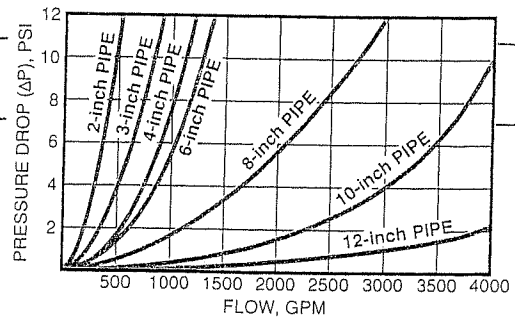
Model Number and Diameter	Cartridge Lengths	Number of Cartridges	Equivalent 10-inch lengths	Available Pipe Sizes	Nominal Flow Rate, GPM
Model 4	10-inch	1	1	3/4, 1, 1-1/4, 1-1/2, 2	50
	20-inch	1	2		
	30-inch	1	3		
	40-inch	1	4		
Model 6	20-inch	3	6	3/4, 1, 1-1/4, 1-1/2, 2, 3	100
	30-inch	3	9		
	40-inch	3	12		
Model 8	20-inch	6	12	3/4, 1, 1-1/4, 1-1/2, 2, 3	220
	30-inch	6	18		
	40-inch	6	24		
Model 12	20-inch	12	24	2,3,4	230
	30-inch	12	36		
	40-inch	12	48		
Model 16	20-inch	20	40	2,3,4	400
	30-inch	20	60		
	40-inch	20	80		
Model 18	20-inch	27	54	2,3,4	600
	30-inch	27	81		
	40-inch	27	108		
Model 22	20-inch	40	80	3,4,6	800
	30-inch	40	120		
	40-inch	40	160		
Model 24	20-inch	52	104	3,4,6	1200
	30-inch	52	156		
	40-inch	52	208		
Model 30	20-inch	82	164	4,6,8	1600
	30-inch	82	246		
	40-inch	82	328		
Model 36	20-inch	116	232	6,8,10	2000
	30-inch	116	348		
	40-inch	116	464		
Model 42	20-inch	158	316	8,10,12	3500
	30-inch	158	474		
	40-inch	158	632		
Model 48	20-inch	205	410	8,10,12	4500
	30-inch	205	615		
	40-inch	205	820		

PRESSURE DROP DATA

Cartridge filters are usually selected so that the clean pressure drop does not exceed 2 psi. Higher pressure drops may be tolerated when contaminant loading is low. The user must determine the appropriate cartridge for the application, and note the flow rate ΔP per cartridge as suggested by the media manufacturer.

VISCOSITY FACTORS

CPS NUMBER								
1 (H_2O)	50	100	200	400	600	800	1000	2000
.65	.85	1.00	1.10	1.20	1.40	1.50	1.60	1.80



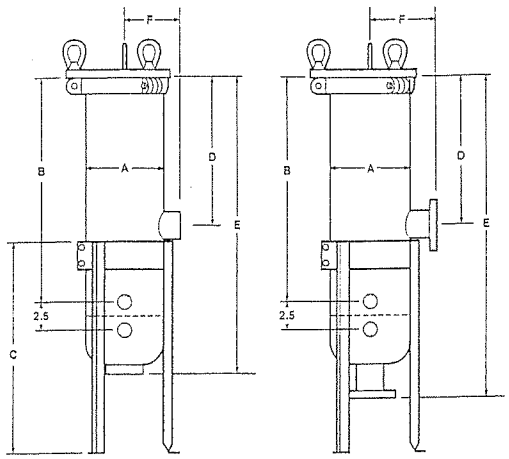
Determining housing pressure drop:

The pressure drops shown on the graph are reliable for all cartridge housings. The pressure drop of any housing is governed by the size of the inlet and outlet, not the vessel itself.

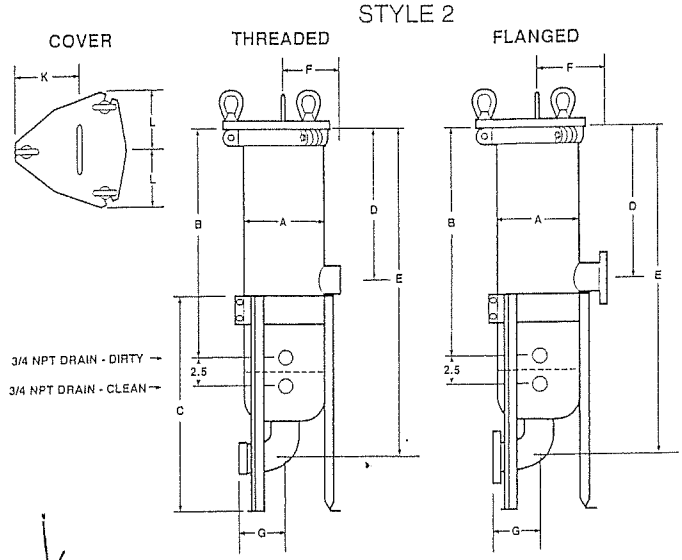
1. Using desired pipe size and approximate flow rate, determine the basic pressure drop from the graph.
2. Multiply the pressure drop obtained in step 1 by the viscosity correction factor found in the accompanying table.
3. You now have the pressure drop for an empty cartridge housing.
4. The user selected cartridge pressure drop must then be added to the housing pressure.

(Approximate in inches)

STYLE 1



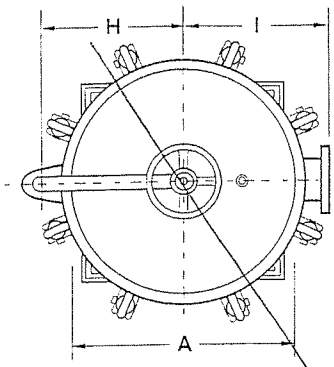
STYLE 2

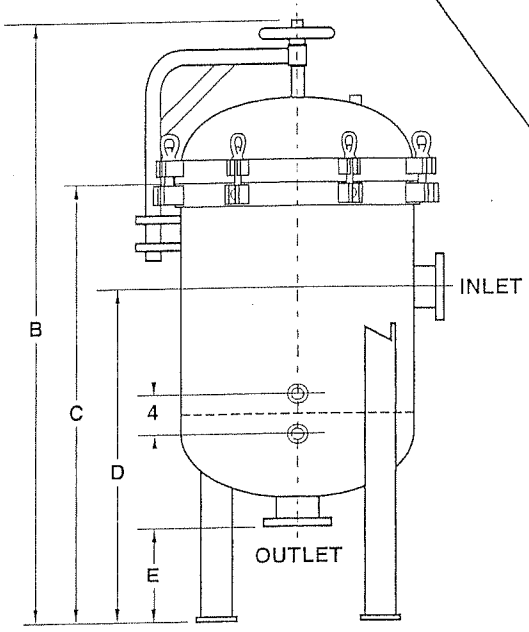


Model No.	No. of Cart.	Cart. Length	Pipe Size	A	B	C	D	STYLE 1 Threaded E	STYLE 1 Threaded F	STYLE 1 Flanged E	STYLE 1 Flanged F	STYLE 2 Threaded E	STYLE 2 Threaded F	STYLE 2 Threaded G	STYLE 2 Flanged E	STYLE 2 Flanged F	STYLE 2 Flanged G
4	1	10	3/4	4.0	11.8	18	6.0	18.7	3.5	19.9	5.0	18.9	3.5	2.1	18.9	5	4
			1					18.6		20.0		19.3		2.5	19.2		
			1-1/4					18.6		20.0		19.6		2.9	19.6		
			1-1/2					18.6		20.2		20.0		3.3	20.0		
			2					18.5		20.1		20.6		4.1	20.6		
4	1	20	3/4	4.0	21.8	18	11.0	28.7	3.5	29.9	5.0	28.9	5.0	2.1	28.9	5	4
			1					28.6		30.0		29.2		2.5	29.2		
			1-1/4					28.6		30.0		29.6		2.9	29.5		
			1-1/2					28.6		30.2		30.0		3.3	30.0		
			2					28.5		30.1		30.6		4.1	30.6		
4	1	30	3/4	4.0	31.8	18	16.0	38.7	3.5	39.9	5.0	38.9	5.0	2.1	38.9	5	4
			1					38.6		40.0		39.2		2.5	39.2		
			1-1/4					38.6		40.0		39.6		2.9	39.6		
			1-1/2					38.6		40.2		40.0		3.3	40.0		
			2					38.5		40.1		40.6		4.1	40.6		
4	1	40	3/4	4.0	41.8	18	21.0	48.7	3.5	49.9	5.0	48.9	3.5	2.1	48.9	5	4
			1					48.6		50.0		49.2		2.5	49.2		
			1-1/4					48.6		50.0		49.6		2.9	49.6		
			1-1/2					48.6		50.2		50.0		3.3	50.0		
			2					48.5		50.1		50.6		4.1	50.6		
6	3	10	1	6.0	11.8	18	6.0	18.6	4.3	19.9	6.0	19.2	6.0	5.0	19.2	4.3	2.5
			1-1/4					18.6		20.0		19.6			19.6		2.9
			1-1/2					18.6		20.1		19.9			20.0		3.3
			2					18.5		20.1		20.6			20.7		4.1
6	3	20	1	6.0	21.8	18	11.0	28.6	4.3	29.9	6.0	29.2	6.0	5.0	29.2	4.3	2.5
			1-1/4					28.6		30.0		29.6			29.6		2.9
			1-1/2					28.6		30.1		29.9			30.0		3.3
			2					28.5		30.1		30.6			30.7		4.1
6	3	30	1	6.0	31.8	18	16.0	38.6	4.3	39.9	6.0	39.2	6.0	5.0	39.2	4.3	2.5
			1-1/4					38.6		40.0		39.6			39.6		2.9
			1-1/2					38.6		40.1		39.9			40.0		3.3
			2					38.5		40.1		40.6			40.7		4.1
6	3	40	1	6.0	41.8	18	21.0	48.6	4.3	49.9	6.0	49.2	6.0	5.0	49.2	4.3	2.5
			1-1/4					48.6		50.0		49.6			49.6		2.9
			1-1/2					48.6		50.1		49.9			50.0		3.3
			2					48.5		50.1		50.6			50.7		4.1
8	6	20	2	8.0	21.7	18	11.0	29.8	5.6	32.0	7.5	31.8	5.6	4.1	31.8	7.5	5.0
			3					30.3		31.4		33.2		6.1	33.2		
→		30	2	8.0	31.7	18	16.0	39.8	5.6	42.0	7.5	41.8	5.6	4.1	41.8	7.5	5.0
			3					40.3		42.0		43.3		6.1	43.2		
		40	2	8.0	41.7	18	21.0	49.8	5.6	52.1	7.5	51.8	5.6	4.1	51.8	7.5	5.0
			3					50.3		51.4		53.2		6.1	53.2		5.0

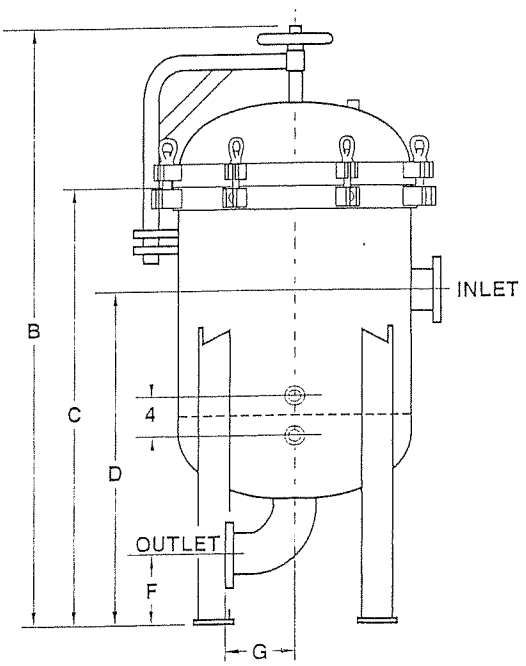
DIMENSIONS for Models 12 thru 48

(Approximate in inches)





STYLE 1



STYLE 2

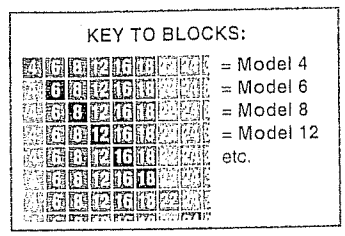
Model No.	No. of Cart.	Cart. Length	Pipe Size	A	STYLE 1 B	C	D	E	STYLE 2 B	C	D	F	G	H	I
12	12	20	2	12.75	59.1	43.1	33.1	12.0	50.6	34.6	24.6	4.5	5.5	9.3	10.4
			3						52.9	36.9	26.9	5.3	7.3		
			4						55.1	39.1	29.1	6.0	9.0		
		30	2	12.75	69.1	53.1	38.1	12.0	60.6	44.6	29.6	4.5	5.5	9.3	10.4
			3						62.9	46.9	31.9	5.3	7.3		
			4						65.1	49.1	34.1	6.0	9.0		
		40	2	12.75	79.1	63.1	43.1	12.0	70.6	54.6	34.6	4.5	5.5	9.3	10.4
			3						72.9	56.9	36.9	5.3	7.3		
			4						75.1	59.1	39.1	6.0	9.0		
16	20	20	2	16.0	61.1	44.1	34.1	12.0	52.6	35.6	25.6	4.5	5.5	10.9	12.0
			3						54.9	37.9	27.9	5.3	7.3		
			4						57.1	40.1	30.1	6.0	9.0		
		30	2	16.0	71.1	54.1	39.1	12.0	62.6	45.6	30.6	4.5	5.5	10.9	12.0
			3						64.9	47.9	32.9	5.3	7.3		
			4						67.1	50.1	35.1	6.0	9.0		
		40	2	16.0	81.1	64.1	44.1	12.0	72.6	55.6	35.6	4.5	5.5	10.9	12.0
			3						74.9	57.9	37.9	5.3	7.3		
			4						77.1	60.1	40.1	6.0	9.0		
18	27	20	2	18.0	62.1	44.6	34.6	12.0	53.6	36.1	26.1	4.5	5.5	11.9	13.0
			3						55.9	38.4	28.4	5.3	7.3		
			4						58.1	40.6	30.6	6.0	9.0		
		30	2	18.0	72.1	54.6	39.6	12.0	63.6	46.1	31.1	4.5	5.5	11.9	13.0
			3						65.9	48.4	33.4	5.3	7.3		
			4						68.1	50.6	35.6	6.0	9.0		
		40	2	18.0	82.1	64.6	44.6	12.0	73.6	56.1	36.1	4.5	5.5	11.9	13.0
			3						75.9	58.4	38.4	5.3	7.3		
			4						78.1	60.6	40.6	6.0	9.0		
22	40	20	2	22.0	64.1	45.6	35.6	12.0	55.6	37.1	27.1	4.5	5.5	13.9	15.0
			3						57.9	39.4	29.4	5.3	7.3		
			4						60.1	41.6	31.6	6.0	9.0		
			6						64.1	45.6	35.6	7.0	12.5		
		30	2	22.0	74.1	55.6	40.6	12.0	65.6	47.1	32.1	4.5	5.5	13.9	15.0
			3						67.9	49.4	34.4	5.3	7.3		
			4						70.1	51.6	36.6	6.0	9.0		
			6						74.1	55.6	40.6	7.0	12.5		
		40	2	22.0	84.1	65.6	45.6	12.0	75.6	57.1	37.1	4.5	5.5	13.9	15.0
			3						77.9	59.4	39.4	5.3	7.3		
			4						80.1	61.6	41.6	6.0	9.0		
			6						84.1	65.6	45.6	7.0	12.5		
24	52	20	2	24.0	65.1	46.1	36.1	12.0	56.6	37.6	27.6	4.5	5.5	14.9	16.0
			3						58.9	39.9	29.9	5.3	7.3		
			4						61.1	42.1	32.1	6.0	9.0		
			6						65.1	46.1	36.1	7.0	12.5		
		30	2	24.0	75.1	56.1	41.1	12.0	66.6	47.6	32.6	4.5	5.5	14.9	16.0
			3						68.9	49.9	34.9	5.3	7.3		
			4						71.1	52.1	37.1	6.0	9.0		
			6						75.1	56.1	41.1	7.0	12.5		
		40	2	24.0	85.1	66.1	46.1	12.0	76.6	57.6	37.6	4.5	5.5	14.9	16.0
			3						78.9	59.9	39.9	5.3	7.3		
			4						81.1	62.1	42.1	6.0	9.0		
			6						85.1	66.1	46.1	7.0	12.5		

Model No.	No. of Cart.	Cart. Length	Pipe Size	A	STYLE 1 B	C	D	E	STYLE 2 B	C	D	F	G	H	I	Empty Weight (lbs)	Total Volume (cu. ft.)
30	82	20	2	30.0	68.1	47.6	37.6	12.0	59.6	39.1	29.1	4.5	5.5	17.9	19.0	955	14.5
			3						61.9	41.4	31.4	5.3	7.3			970	
			4						64.1	43.6	33.6	6.0	9.0			990	
			6						68.1	47.6	37.6	7.0	12.5			1035	
			8						72.4	51.9	41.9	8.3	16.0			1100	
		30	2	30.0	78.1	57.6	42.6	12.0	69.6	49.1	34.1	4.5	5.5	17.9	19.0	1030	18.6
			3						71.9	51.4	36.4	5.3	7.3			1045	
			4						74.1	53.6	38.6	6.0	9.0			1060	
			6						78.1	57.6	42.6	7.0	12.5			1110	
			8						82.4	61.9	46.9	8.3	16.0			1170	
		40	2	30.0	88.1	67.6	47.6	12.0	79.6	59.1	39.1	4.5	5.5	17.9	19.0	1100	22.7
			3						81.9	61.4	41.4	5.3	7.3			1120	
			4						84.1	63.6	43.6	6.0	9.0			1135	
			6						88.1	67.6	47.6	7.0	12.5			1180	
			8						92.4	71.9	51.9	8.3	16.0			1245	
36	116	20	2	36.0	71.1	49.1	39.1	12.0	62.6	40.6	30.6	4.5	5.5	20.9	22.0	1315	22.0
			3						64.9	42.9	32.9	5.3	7.3			1330	
			4						67.1	45.1	35.1	6.0	9.0			1350	
			6						71.1	49.1	39.1	7.0	12.5			1395	
			8						75.4	53.4	43.4	8.3	16.0			1460	
			10						79.6	57.6	47.6	9.5	19.0			1570	
		30	2	36.0	81.1	59.1	44.1	12.0	72.6	50.6	35.6	4.5	5.5	20.9	22.0	1425	27.9
			3						74.9	52.9	37.9	5.3	7.3			1440	
			4						77.1	55.1	40.1	6.0	9.0			1460	
			6						81.1	59.1	44.1	7.0	12.5			1505	
			8						85.4	63.4	48.4	8.3	16.0			1570	
			10						89.6	67.6	52.6	9.5	19.0			1680	
		40	2	36.0	91.1	69.1	49.1	12.0	82.6	60.6	40.6	4.5	5.5	20.9	22.0	1535	33.8
			3						84.9	62.9	42.9	5.3	7.3			1550	
			4						87.1	65.1	45.1	6.0	9.0			1570	
			6						91.1	69.1	49.1	7.0	12.5			1615	
			8						95.4	73.4	53.4	8.3	16.0			1680	
			10						99.6	77.6	57.6	9.5	19.0			1790	
42	158	20	2	42.0	74.1	50.6	40.6	12.0	65.6	42.1	32.1	4.5	5.5	23.9	25.0	2030	31.6
			3						67.9	44.4	34.4	5.3	7.3			2045	
			4						70.1	46.6	36.6	6.0	9.0			2060	
			6						74.1	50.6	40.6	7.0	12.5			2110	
			8						78.4	54.9	44.9	8.3	16.0			2170	
			10						82.6	59.1	49.1	9.5	19.0			2280	
			12						87.1	63.6	53.6	11.0	22.5			2415	
		30	2	42.0	84.1	60.6	45.6	12.0	75.6	52.1	37.1	4.5	5.5	23.9	25.0	2160	39.6
			3						77.9	54.4	39.4	5.3	7.3			2175	
			4						80.1	56.6	41.6	6.0	9.0			2195	
			6						84.1	60.6	45.6	7.0	12.5			2240	
			8						88.4	64.9	49.9	8.3	16.0			2305	
			10						92.6	69.1	54.1	9.5	19.0			2415	
			12						97.1	73.6	58.6	11.0	22.5			2550	
		40	2	42.0	94.1	70.6	50.6	12.0	85.6	62.1	42.1	4.5	5.5	23.9	25.0	2285	47.6
			3						87.9	64.4	44.4	5.3	7.3			2300	
			4						90.1	66.6	46.6	6.0	9.0			2320	
			6						94.1	70.6	50.6	7.0	12.5			2360	
			8						98.4	74.9	54.9	8.3	16.0			2430	
			10						102.6	79.1	59.1	9.5	19.0			2535	
			12						107.1	83.6	63.6	11.0	22.5			2670	
48	205	20	2	48.0	77.1	52.1	42.1	12.0	68.6	44.1	34.1	4.5	5.5	26.9	28.0	2510	43.2
			3						70.9	46.4	36.4	5.3	7.3			2520	
			4						73.1	48.6	38.6	6.0	9.0			2540	
			6						77.1	52.6	42.6	7.0	12.5			2585	
			8						81.4	56.9	46.9	8.3	16.0			2650	
			10						85.6	61.1	51.1	9.5	19.0			2760	
			12						90.1	65.6	55.6	11.0	22.5			2895	
		30	2	48.0	87.1	62.1	47.1	12.0	78.6	54.1	39.1	4.5	5.5	26.9	28.0	2655	53.7
			3						80.9	56.4	41.4	5.3	7.3			2670	
			4						83.1	58.6	43.6	6.0	9.0			2685	
			6						87.1	62.6	47.6	7.0	12.5			2730	
			8						91.4	66.9	51.9	8.3	16.0			2800	
			10						95.6	71.1	56.1	9.5	19.0			2905	
			12						100.1	75.6	60.6	11.0	22.5			3040	
		40	2	48.0	97.1	72.1	52.1	12.0	88.6	64.1	44.1	4.5	5.5	26.9	28.0	2800	64.1
			3						90.9	66.4	46.4	5.3	7.3			2815	
			4						93.1	68.6	48.6	6.0	9.0			2830	
			6						97.1	72.6	52.6	7.0	12.5			2880	
			8						101.4	76.9	56.9	8.3	16.0			2945	
			10						105.6	81.1	61.1	9.5	19.0			3050	
			12						110.1	85.6	65.6	11.0	22.5			3180	

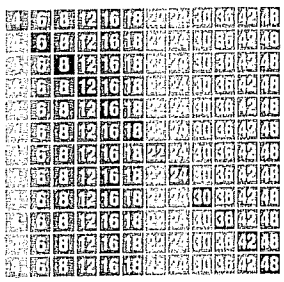
Empty Weight (lbs)	Total Volume (cu. ft.)
370	2.2
385	
410	
395	2.9
410	
425	
420	3.7
435	
455	
450	3.6
465	
480	
475	4.8
495	
510	
505	5.9
520	
540	
480	4.7
500	
515	
515	6.1
530	
550	
550	7.6
565	
580	
615	7.3
630	
645	
690	
655	9.5
670	
690	
730	
695	11.7
710	
730	
770	
665	8.8
680	
700	
745	
710	11.4
725	
740	
790	
750	14.0
770	
785	
830	

HOW TO ORDER CARTRIDGE FILTER HOUSINGS

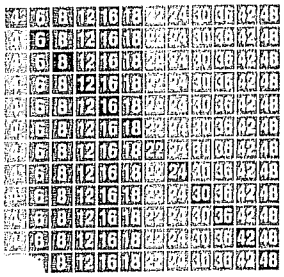
Build an ordering code as shown in the example. Each option is available only on the model sizes highlighted in the colored blocks preceding its description



EXAMPLE: 24 52 30 4F 1 150 N C B DOE VP



MODEL NO.
= 4
= 6
= 8
= 12
= 16
= 18
= 22
= 24
= 30
= 36
= 42
= 48

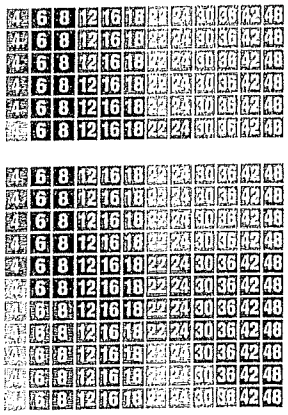


NUMBER OF CARTRIDGES[4] (Around)

Cartridges	
1	= 1
3	= 3
6	= 6
12	= 12
20	= 20
27	= 27
40	= 40
52	= 52
82	= 82
116	= 116
158	= 158
205	= 205

CARTRIDGE LENGTH[4]

10-in.	= 10
20-in.	= 20
30-in.	= 30
40-in.	= 40



PIPE SIZE

NPT (female)

3/4-in.	= 3/4P
1-in.	= 1P
1-1/4-in.	= 1-1/4P
1-1/2-in.	= 1-1/2P
2-in.	= 2P
3-in.	= 3P

FLANGED[1]

3/4-in.	= 3/4F
1-in.	= 1F
1-1/4-in.	= 1-1/4F
1-1/2-in.	= 1-1/2F
2-in.	= 2F
3-in.	= 3F
4-in.	= 4F
6-in.	= 6F
8-in.	= 8F
10-in.	= 10F
12-in.	= 12F

CARTRIDGE SEALING METHOD

VP =	V Post and Spring Seal
TP =	Threaded Post

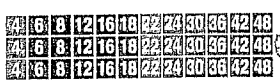
For other styles, consult factory

CARTRIDGE DESIGN[4]

DOE =	Double-Open End
SOE =	Single-Open End
222 =	Double O-Ring
226 =	Bayonet Lock (Pall)

COVER GASKET

B =	Buna N
E =	Ethylene Propylene
V =	Viton®
TEV =	Teflon® Encapsulated Viton
TSW =	Teflon® Solid White



HOUSING MATERIAL[2]

C =	Carbon Steel
S =	304 Stainless Steel
316S =	316 Stainless Steel

ASME CODE STAMP

N =	None
C =	Code

PRESSURE RATING[3]

150 =	150 psi
300 =	300 psi

PIPING STYLE[2]

1 =	Side Inlet, Bottom Outlet
2 =	In-line, Inlet-high, Outlet-low

MODEL #

8 6 30 2P 1 150 S B DOE VP

1. ANSI 150-lb flanges are provided as standard for vessels rated 150 psi. Other styles and classes are available. ANSI B16.5 Pressure-Temperature rating tables determine flange class for ASME code housings. Consult factory.

2. Consult factory for special options.

3. Higher pressure ratings available. Consult factory.

4. Filter cartridges are sold separately. Consult your local distributor.

ROSEDALE PRODUCTS, INC.

Box 1085, Ann Arbor, MI 48106

Tel: 313-665-8201 Fax: 313-665-2214

Catalog CD-200 6/92 Printed in USA

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

ROSEDALE PRODUCTS, INC.

MODEL 8

150 PSIG RATED FILTER UNIT

MODEL #
8630 2P1150 S B DOE VP

Table of Contents

I. Installation

Please remove all shipping and crating materials carefully. Be sure to remove the plugs from the inlet and outlet openings. Dispose of all crating materials safely.

The Model 8 Filter unit is capable of having several different piping variations based upon the outlet style of your unit. The inlet service line should be connected to the inlet flange or NPT coupling located near the top of the unit (above the basket level).

The outlet service line should be connected to the outlet flange or coupling, located near the middle or bottom of the unit depending upon the style of your unit (below basket level).

There are two 1/4" NPT ports on the shell and one 1/4" NPT port on the cover of the Model 8 Filter unit. These ports can remain plugged or used for pressure gauges or special fittings as your application requires.

Some installations require electrical grounding of all equipment, be sure to provide adequate grounding where necessary.

After completing installation be sure to double check connections for integrity. Your Model 8 Filter unit has been factory pressure tested leak free, therefore, any seepage problems usually occur from improper installation connections.

You are now ready to install the filter basket and bag. Remove cover by loosening the cover eyenuts. The eyenuts in the slotted corners should be loosened sufficiently to swing free. Loosen the third eyenut sufficiently to allow the top cover and closure assembly to swing away from the top of the unit.

If your application requires a basket seal, insert the basket seal into the basket collar groove. Refer to Figure 1 or Figure 2 in the Spare Parts Diagram for installation position of your seal.

Place the basket into the filter housing, make sure the basket flange is firmly seated into the basket collar.

Insert bag into the bag basket making sure filter bag ring is firmly seated inside the basket flange. For best results, be sure filter bag is installed fully extended to the bottom of the basket.

Before replacing cover assembly, inspect cover seal gasket (replacing as necessary). Close cover and alternately tighten the three clamp assemblies evenly to ensure a leak proof seal between the cover and housing body. Torque closure assemblies to a minimum of $150^{\text{inch-lbs}}$. Higher torque may be required depending on your application and filter condition.

Your Rosedale Model 8 is now ready for operation!

II. Operation

Filter System Start-Up Procedure:

Prior to turning on the flow to the inlet service, please make the following checks:

1. Check inside filter unit to be sure basket and filter bag (if applicable) are in housing and do not require cleaning or replacement. If necessary install a clean filter basket and bag (if applicable).

2. Check that filter unit cover is securely fastened to housing. You are now ready to open the flow to the inlet service line. Slowly open the inlet service line approximately 25% of normal operational flow (open slowly as not to displace filter bag inside the housing). After filter unit is pressurized and vented, slowly open outlet service line unit valve until completely open. Complete opening of inlet service line until desired flow rate is reached.

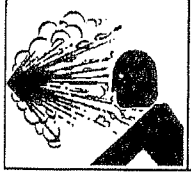
Once the desired service flow has been established, the filter will operate efficiently until dirty. However, under no circumstances should more than *15 PSI Differential Pressure* through the filter be obtained. Operating the filter unit with a high differential may cause filter bags to rupture and/or cause damage to filter system and downstream equipment..

To prevent excessive drop through the filter unit, regular inspection of the filter media is required. Monitoring of differential pressure through the housing can be utilized as a means of determining whether or not the filter media needs cleaning or replacement.

When it becomes necessary to clean or replace filter media, follow the procedure outlined below:

1. First close the flow from the inlet service line.
2. Close the flow to the outlet service line. (In some applications closing flow to outlet is not required.)
3. Relieve the pressure from the filter unit.

⚠ WARNING



CONTENTS UNDER PRESSURE
Relieve Pressure in accordance with Manufacturer's instructions before opening Filter Vessel.
FAILURE TO DO SO MAY RESULT IN SERIOUS BODILY INJURY.

4. Drain housing sufficiently to access filter basket.
5. Remove cover by loosening the cover eyenuts. The eyenuts in the slotted corners should be loosened sufficiently to swing free. Loosen the third eyenut sufficiently to allow the top cover and closure assembly to swing away from the top of the unit.
6. Remove filter basket and clean thoroughly, remove the filter bag (if applicable) and throw away. (Cleaning and reusing the filter bag is not recommended.)
7. Remove debris and sludge from inside the inlet portion of housing to avoid interference

with cover seal or flow of fluid being filtered.

8. Remove basket seal and inspect, replace if necessary. Clean basket seal groove and replace basket seal (see spare parts diagram for location of basket seal).
9. Install clean filter basket and filter bag (if applicable). Place the basket into the filter housing, make sure the basket flange is firmly seated into the basket collar. If applicable, insert bag into the bag basket making sure filter bag ring is firmly seated inside the basket flange. For best results, be sure filter bag is installed fully extended to the bottom of the basket.
10. Inspect cover gasket for cuts or other signs of failure and make sure it is properly seated.
11. Move cover back into position, and alternately tighten the three clamp assemblies evenly to ensure a leak proof seal between cover and housing body. Torque closure assemblies to a minimum of $150^{\text{inch-lbs}}$. Higher torque may be required depending on your application and filter condition.

Your Rosedale Model 8 Filter unit is now ready for operation. Refer to filter system start-up procedure.

III. Spare Parts List

Your Rosedale Model 8 Filter unit will give you many years of reliable service provided periodic inspections are made of various components and replacement of worn parts are made promptly. The following is meant to be a recommended spare parts list, these parts are illustrated on the following page.

SPARE PARTS LIST

Balloon	Description	Part Number	Time-Frame
1	Cover Seal	8150CG-*	as needed
2	Basket Seal	8BG-*	as needed
3	Cover	8*150	as needed
4	Eye Nut	8ENNI	as needed
5	Rod End	8RENI	as needed
6	Clevis Pin Assembly	8CPNI	as needed
7	Filter Bag	(See Order)	as needed
8	Filter Basket	(See Order)	as needed
9	Tripod Legs	8T22*S	as needed

* Select Material Designation:

C = Carbon Steel
S = 304 Stainless Steel
S316 = 316 Stainless Steel

B = Buna N
E = Ethylene Propylene
V = Viton
TEV = Teflon Encapsulated Viton
TSW = Teflon Solid White

IV. Spare Parts Diagram

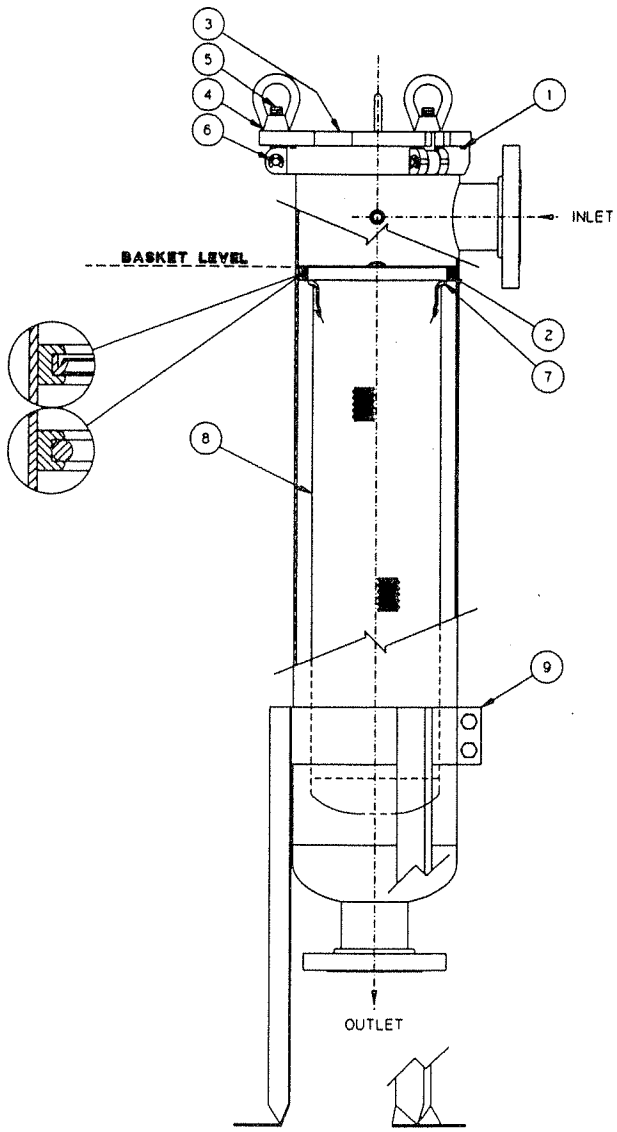


Figure 1
'V'-seal

Figure 2
O-ring

Important Notice

Warranty: In the event any Rosedale Products, Inc. filtration product is found to be defective in material, workmanship, or not in conformance with any express warranty for a specific purpose, Rosedale's only obligation and your exclusive remedy, shall be to repair, replace or refund the purchase price of such parts or products upon timely notification thereof and substantiation that the product has been stored, maintained and used in accordance with Rosedale's written instructions.

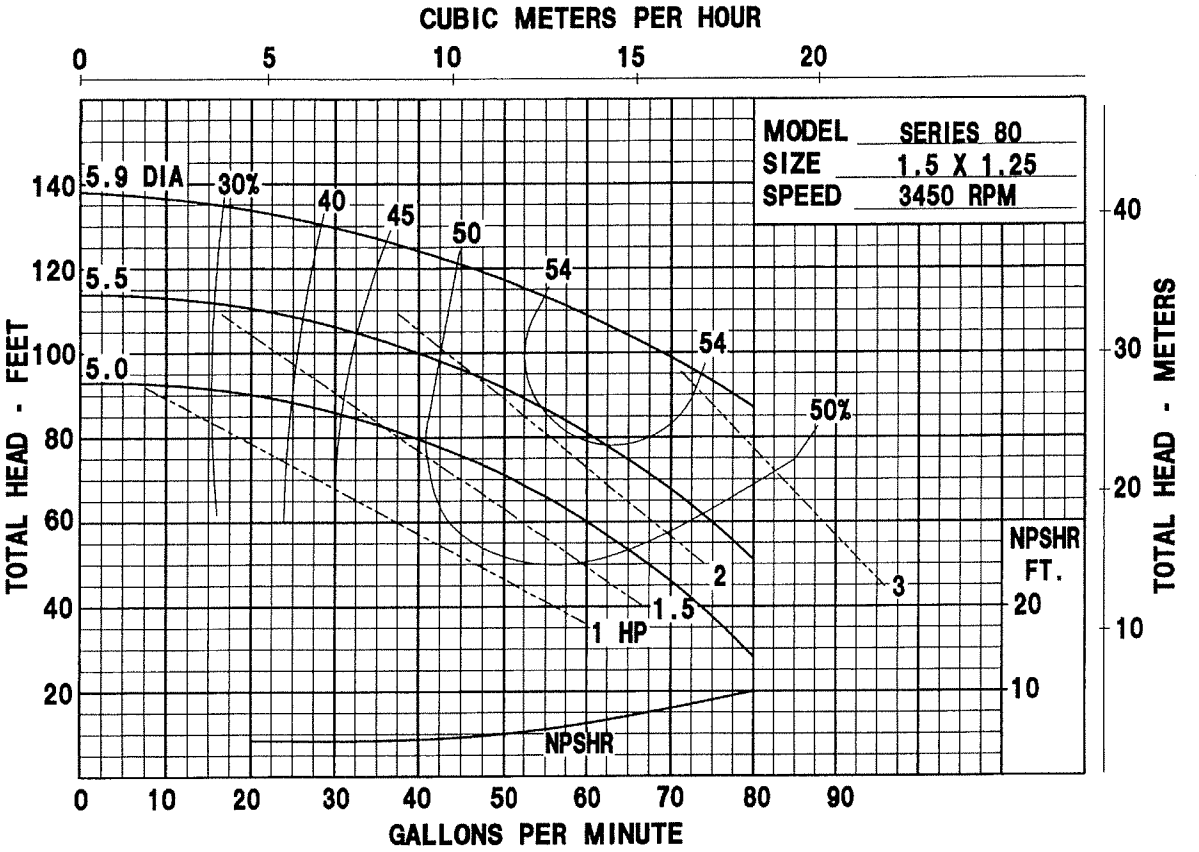
EXCLUSIONS TO WARRANTY: **THIS WARRANTY IS EXCLUSIVE AND IS IN LIEU OF ANY IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OTHER WARRANTY OF QUALITY, EXCEPT OF TITLE AND AGAINST PATENT INFRINGEMENT.**

LIMITATION OF LIABILITY: Except as provided above, Rosedale shall not be liable or responsible for any loss or damage, whether direct, indirect, incidental, special or consequential, arising out of sale, use or misuse of Rosedale filtration products, or the user's inability to use such products.

THE REMEDIES SET FORTH HEREIN ARE EXCLUSIVE.

Rosedale Products, Inc.
3730 West Liberty Road
Ann Arbor, MI 48103 USA
734-665-8201
800-821-5373
Fax. 734-665-2214
filters@rosedaleproducts.com
http://www.rosedaleproducts.com

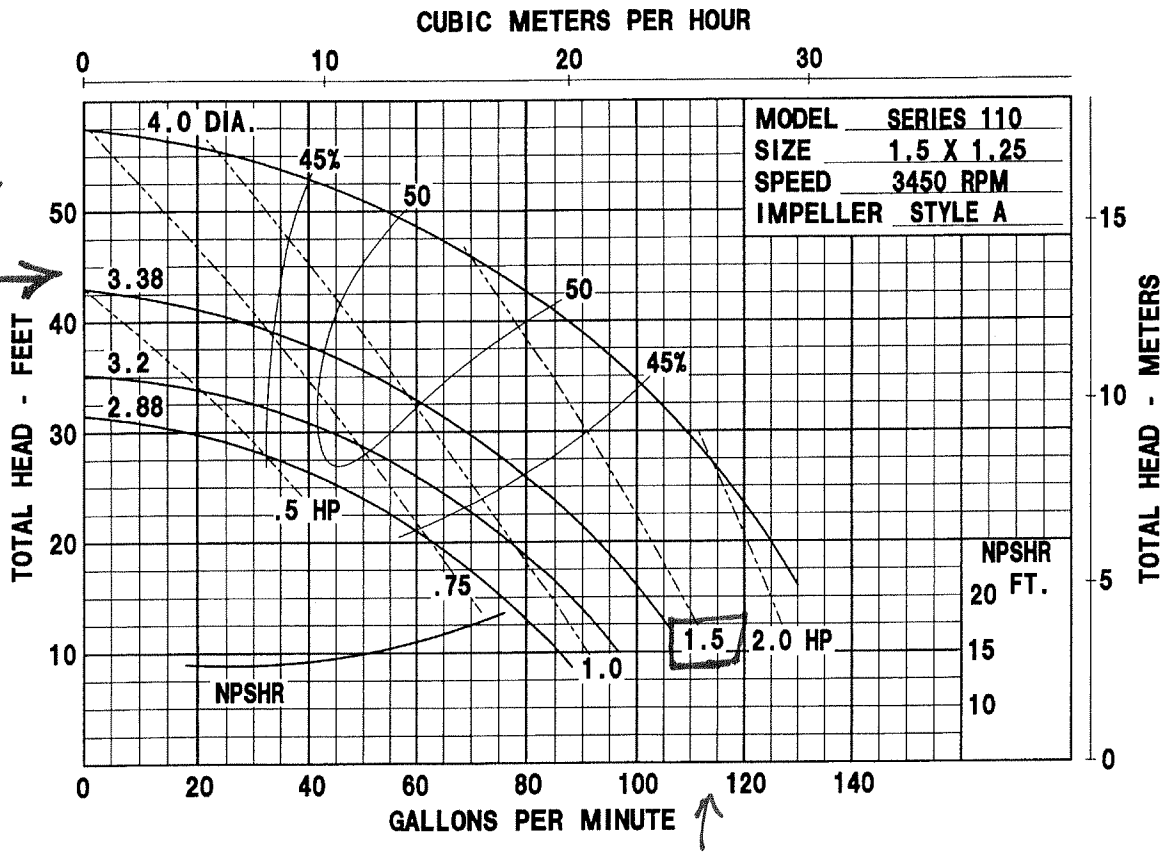
Series 80 Pump Performance Curves



TRANSFER PUMP

PUMP MODEL 24869

Series 110 Pump Performance Curves

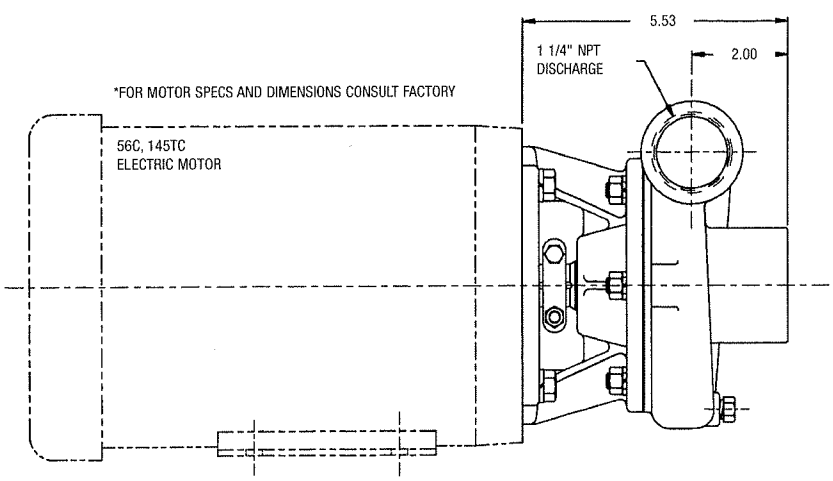


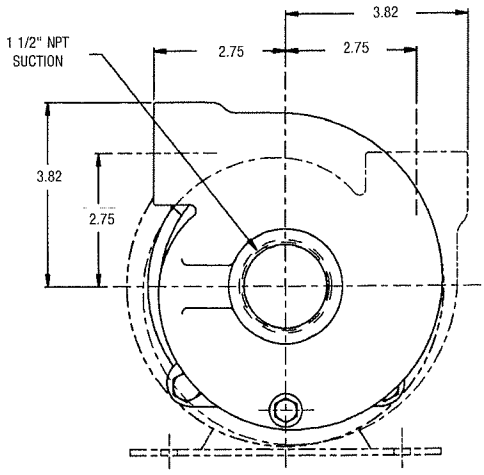
3.38" IMP

1.5 HP

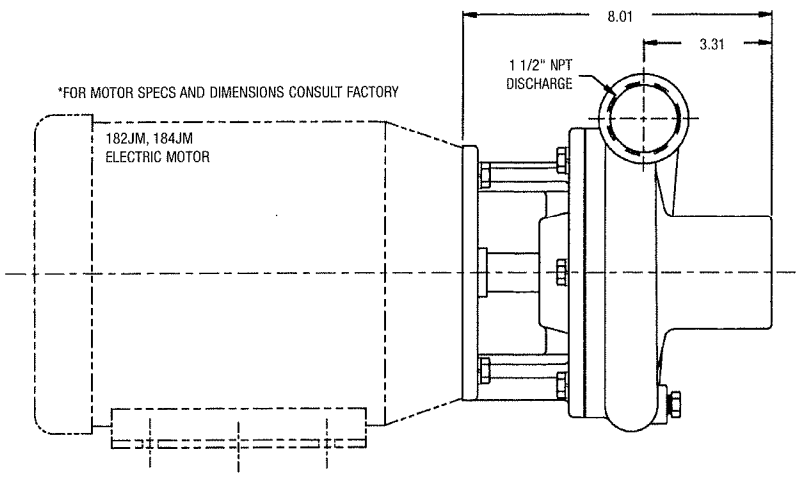
Other Performance Curves Available Upon Request

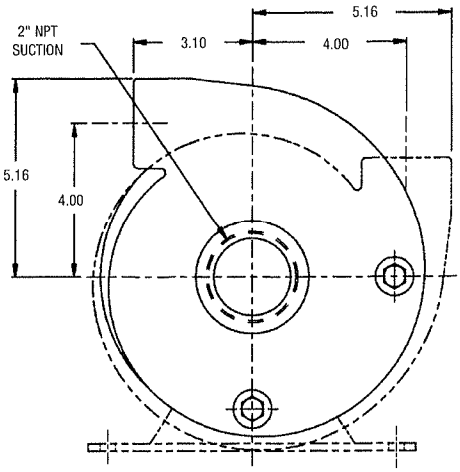
Series 110 Dimensions



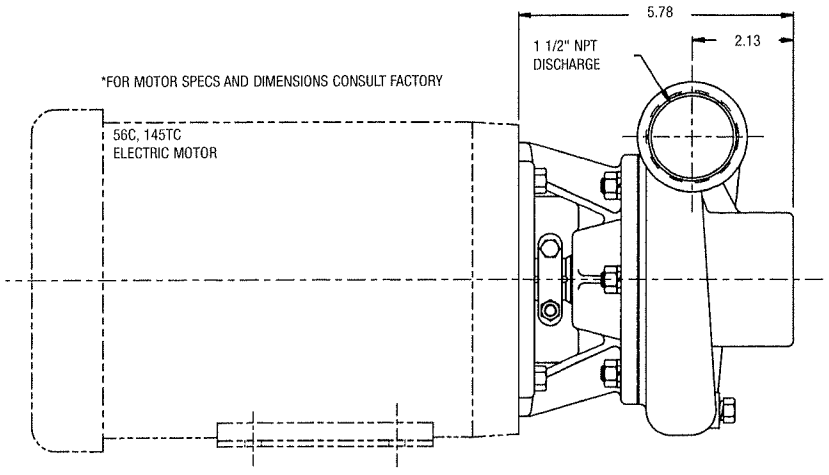


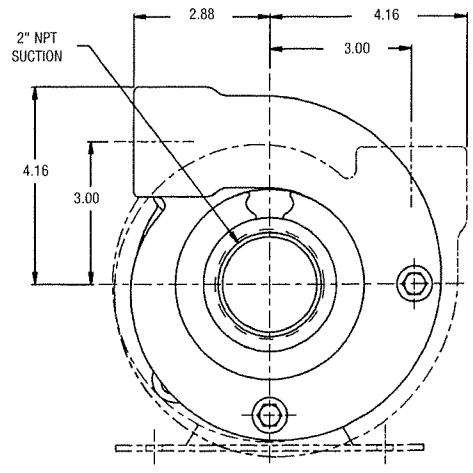
Series 120 Dimensions





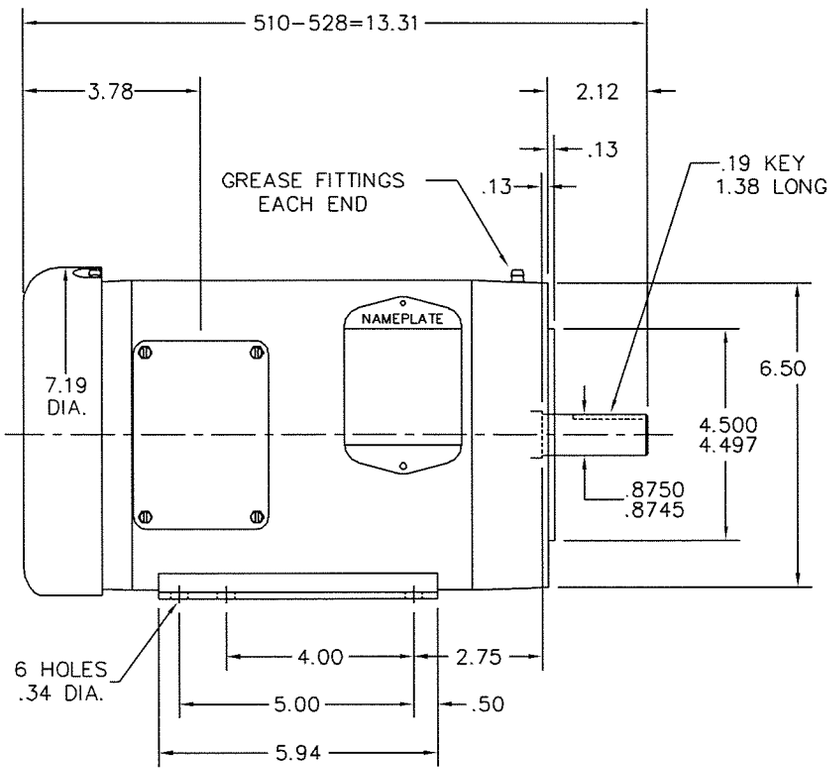
Series 130 Dimensions

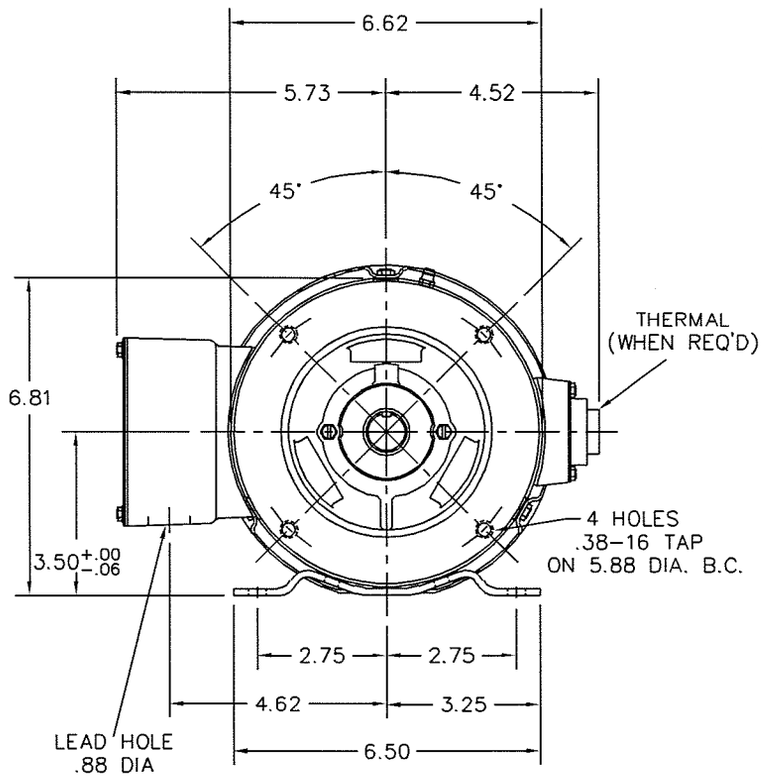




HI-SHELL001826

35LYS077





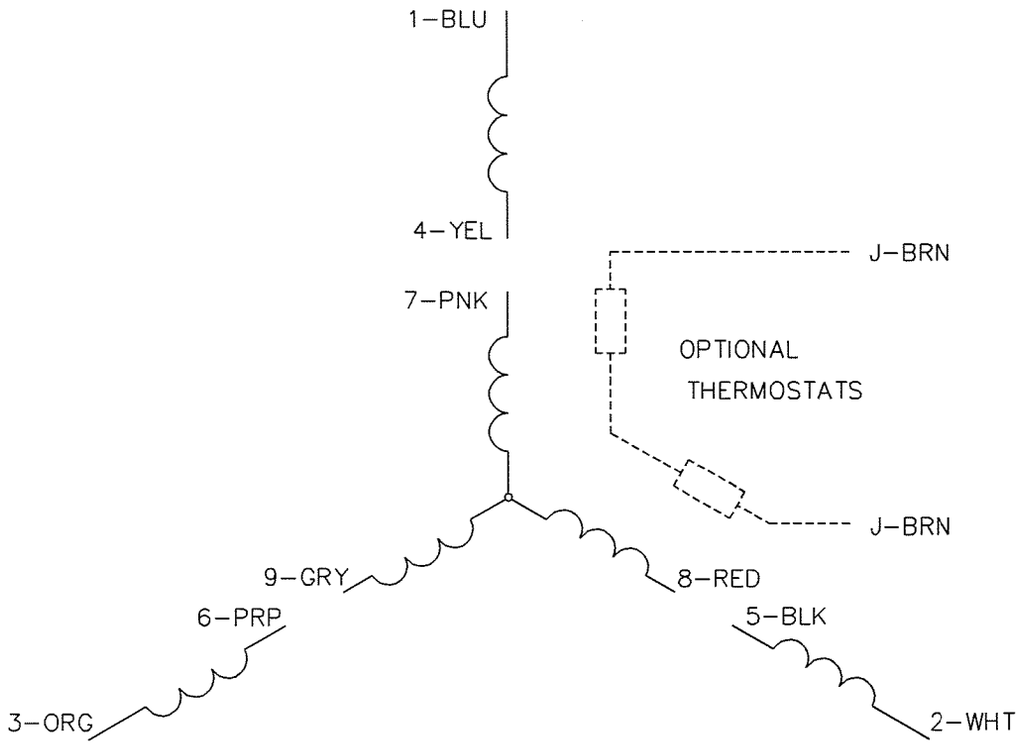
TRANSFER PUMP MOTOR

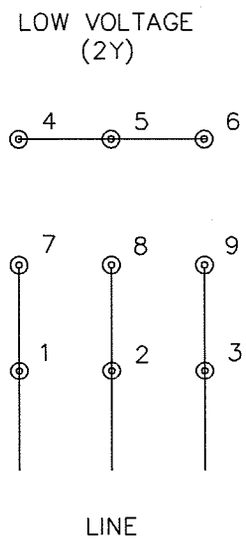
CUST. NAME		CUST. P.O.		CERTIFIED BY		MODEL		INSUL	AMB
H.P. 1.5 HP	MTG	TYPE	R.P.M.	VOLTS		ENCL	PHASE	FREQ	FRAME
REV. DESC: CHG'D CONDUIT BOX AND LID (SEE EC09)						BALDOR ELECTRIC Co.			
REV. LTR: E	BY: JED	REVISED: 04/07/99 2:48		TDR: 0171817					
35LYS077		FILE: AAA00015547		MDL: –		STD HORZ TEFC 35M 143-5TC			
		MTL: –							

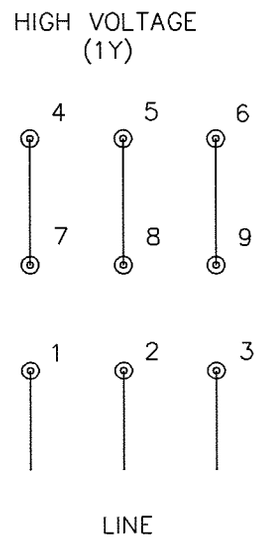
35LYS077

HI-SHELL001827

CD0005







NOTES:

1. INTERCHANGE ANY TWO LINE LEADS TO REVERSE ROTATION.
2. OPTIONAL THERMOSTATS ARE PROVIDED WHEN SPECIFIED.
3. ACTUAL NUMBER OF INTERNAL PARALLEL CIRCUITS MAY BE A MULTIPLE OF THOSE SHOWN ABOVE.
4. LEAD COLORS ARE OPTIONAL. LEADS MUST ALWAYS BE NUMBERED AS SHOWN.

REV. DESC: REVISE TO SHOW OPTIONAL COLORS			
REV. LTR: E	BY: JLP	REVISED: 01/19/99 10:15	TDR: 0171435
CD0005		FILE: AAA00005140	MDL: –
		MTL: –	

BALDOR ELECTRIC Co.

3PH, DV, 9 LEADS

CD0005

GRAINGER # 4A821
($5.00)

ES-FV-4M1

For Hydronic Heating Applications

Job Name _____ Contractor _____

Job Location _____ Approval _____

Engineer _____ Contractor's P.O. No. _____

Approval _____ Representative _____

Series FV-4M1

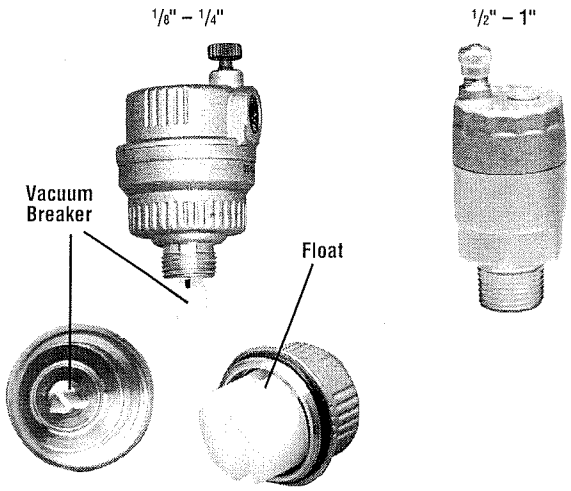
Automatic Air Vent Valves

Sizes: ⅛" – 1" (3 – 25mm)

Series FV-4M1 Automatic Air Vent Valves provide automatic air venting for hot or cold water distribution systems. These vents purge air that may be in the water system.

The vent valve utilizes a float to actuate the valve plug which is located at the top of the valve. Once the air is displaced and the system pressure is sustained, the valve plug seals and prevents any water from escaping from the system.

The float vent can also operate as an anti-vacuum device since it will permit air to enter the system when it must be drained. It can also be installed to permit the separation and dispersal of air while fluid is actually circulating in the system.



Features

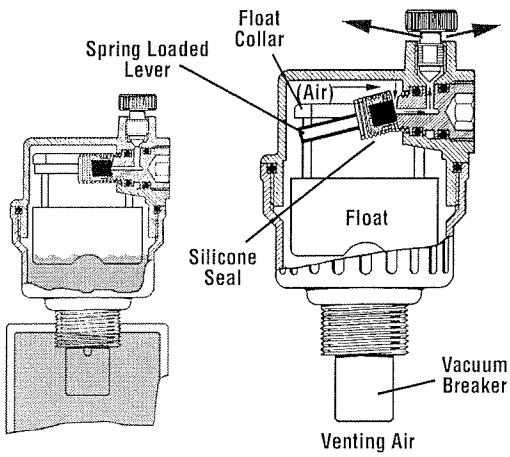
- Body and cover are brass construction
- Air vent with silicone rubber seal
- Impurities do not usually affect function as maximum float line of water is always lower than the valve seal
- Float is high temperature resistant polyethylene
- Suitable for use with glycol systems
- Can be disassembled for inspection and cleaning

Pressure – Temperature

Minimum working pressure: 1.45psi (10 kPa)

Maximum working pressure: 150psi (10 bars)

Temperature Range: 33°F – 240°F (5°C – 116°C)



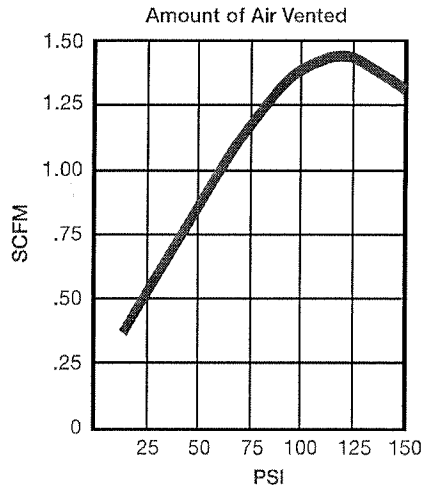


Diagram above shows the quantity of air vented by the "Float Vent" according to the pressure in the system.

Specifications

Air vent shall have brass body & cover and silicone rubber seal. Float shall be constructed of high temperature resistant polyethylene and shall be for use with glycol systems. Air vent shall be Watts Regulator Company Series FV-4M1.

WATTS® REGULATOR

Installation

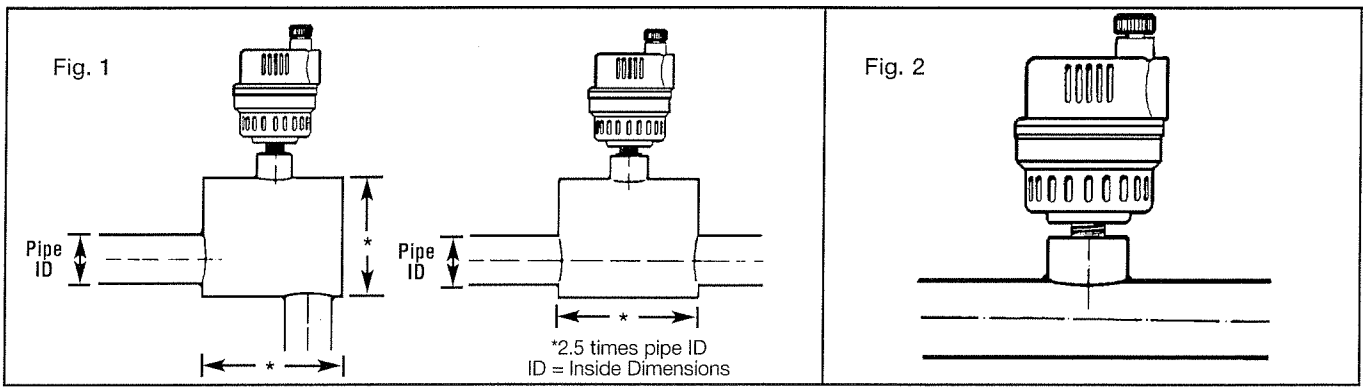


Figure 1 shows the installation of the FV-4M1 for the venting of air while the fluid is circulating in the system. The figure shows the required increase in pipe size in order to obtain proper separation of air from water. Watts Series AS Air Scoop which is designed for efficient separation of air from water in hydronic heating systems can also be installed. See Watts literature S-AS.

Figure 2 – When the FV-4M1 is installed as shown, the air will not be vented while the fluid is circulating in the system, but it can vent when the system is shut off.

The FV-4M1 should be mounted only in a vertical position as its operation is based on the vertical movement of the float (see Fig. 3).

Note: In order to get the best results in venting air from risers, use connecting pipes of at least ½" diameter between the "Float Vent" valves and the installation.

Maintenance

No maintenance is normally necessary. However, if the FV-4M1 is disassembled for inspection or cleaning it is important that when re-assembling to ensure that the spring loaded lever properly engages under the float collar (see reverse side).

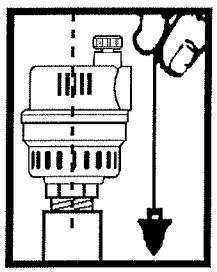


Fig. 3

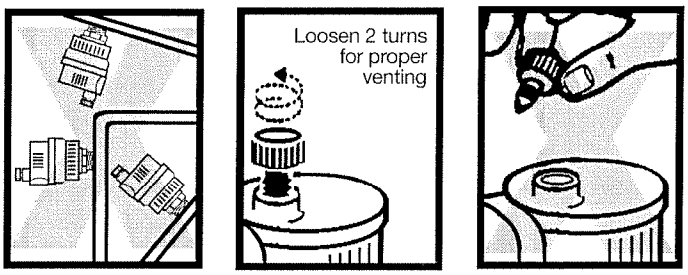


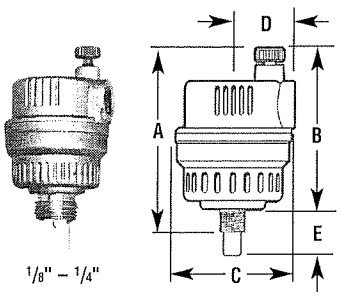
Fig. 4

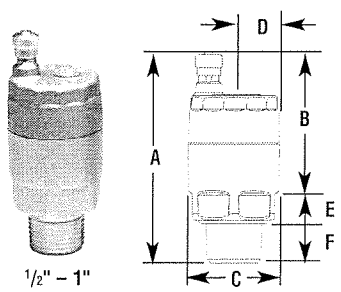
Operation: IMPORTANT!

After installing the FV-4M1, back off the small vent cap two turns (see Fig. 4). This is the proper operating setting which will allow air to be vented from the system. It is advisable to leave the cap on to prevent impurities from entering the valve.

Dimensions – Weights

SIZE (DN)		DIMENSIONS										WEIGHT	
		A		B		C		D		E		F			
in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	lbs.	kg
⅛	3	2 15/16	75	2⅝	67	1⅝	41	13/16	21	5/16	7.9	5/16	7.9	.40	.18
¼	8	3⅛	79	2⅝	67	1⅝	41	13/16	21	⅛	3.1	½	12.7	.43	.20
½	15	3 5/16	85	2 11/16	69	1¼	32	11/16	18	⅝	16	–	–	.44	.20
¾	20	3⅜	85	2 11/16	69	1¼	32	11/16	18	⅝	16	–	–	.45	.20
1	25	3½	89	2 11/16	69	1⅜	35	11/16	18	13/16	20	–	–	.47	.21





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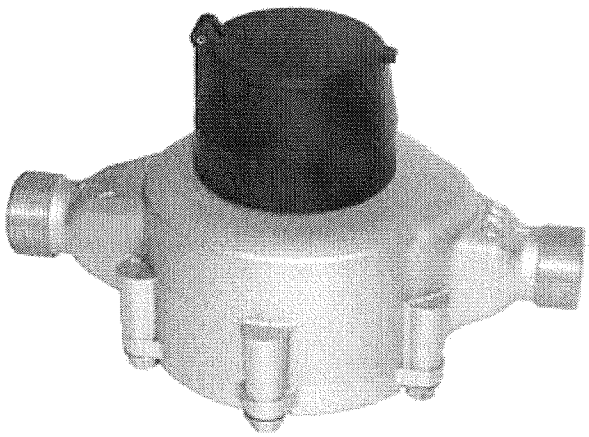
Specification Sheet

Industrial Positive Displacement Meter

Model C700 Bronze, Magnetic Drive, External Threaded Spuds

Size: 1”



Description

Operation. The C700 is an oscillating piston style, positive displacement water meter. The product utilizes a piston that water use rotates in a measuring chamber, each piston revolution being equivalent to a known volume of water. The piston movement is transferred by a magnetic drive to a straight reading sealed register which contains the appropriate reduction gearing.

Compliance to Standards. The C700 fully complies with American Water Works Association Standard C700, latest revision, and is California Department of Weights and Measures approved. C700 low-lead bronze models are NSF-61certified and comply with California Proposition 65.

Installation. The meter must be installed in a clean pipeline, free from any foreign materials. Install the meter with direction of flow as indicated by the arrow cast in the meter case. The meter may be installed in horizontal, vertical or inclined lines.

Application. The meter is for use only with POTABLE COLD WATER up to 120°F (50°C) and working pressures up to 150 psi. The meter will register accurately to 100% ± 1 1/2% within the normal flows. Accuracy tests are made before shipment, so no adjustments need to be made before installation.

Construction. The meter consists of a straight through-flow main case, dual inlet measuring chamber, vertically grooved oscillating piston, high capacity strainer, removable bottom plate, full rubber liner, body bolts with integral washers and a magnetically driven register. The main case is cast in waterworks or low-lead bronze with raised characters designating model, size and direction of flow. Maincase bottom plates are available in a choice of waterworks or low-lead bronze or, if frost protection is desired, in cast iron. The 2-piece snap-fit measuring chamber is of a top and bottom inlet, side output design and features a unique self-flushing sediment well. Other features include a removable, contoured division plate, captive drive bar and high

Specifications

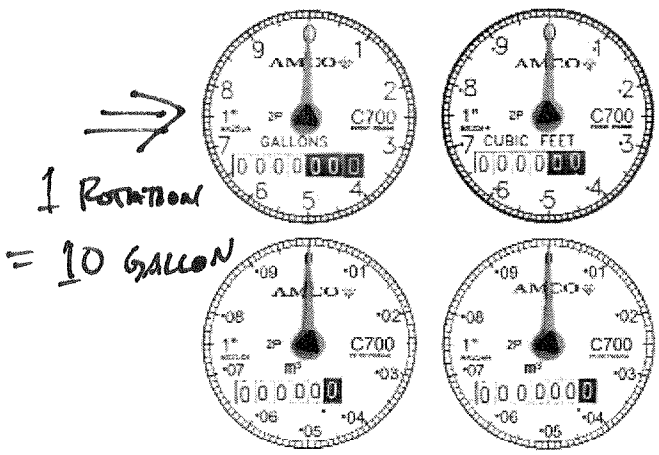
Size:	1"
95%-101% Accuracy GPM	3/4
98.5% -101.5% Accuracy GPM	3-50
Continuous Flow GPM	25
Maximum Flow GPM	50
Operating Pressure psi	150
Operating Temperature °F	120
Sweep Hand Registers:	
US Gallons	10 ←
Cubic Feet	1
Cubic Meters (Canada)	1/10
Cubic Meters (Intl.)	1/10
Capacity of Register (millions):	
US Gallons (millions)	10 ←
Cubic Feet (millions)	10
Cubic Meters (Canada)	1/10
Cubic Meters (Intl.)	1
Register Type:	Permanently sealed direct reading
Materials:	
Main Case	Standard waterworks or optional low-lead Bronze
Bottom Plate Options	Waterworks or low-lead Bronze or Cast Iron
Bottom Gasket-Liner	Nitrile
Body Bolts	Stainless Steel
Measuring Chamber	Compounded Polymer
Division Plate	Loaded Nylon
Piston	High Impact Polymer
Thrust Bearing Insert	Loaded Nylon
Driving Bar	Loaded Nylon
Strainer	Polypropylene
Register Can	90% Copper Alloy
Register Lens	Tempered Glass
Register Housing and Lid	Polymer or Bronze

ELSTER AMCO

AMCO

torque magnet complete with a nylon bushing. The flow-stream balanced piston has a unique thrust bearing insert and features a Turbulence Seal™ system which passes debris while sustaining the most linear accuracy curve in the industry. Each register is secured to the main case with a tamperproof plug to eliminate tampering.

Direct Read Register. The register is contained within a 90% copper seamless can which is oven-cured at 150°F for 90 minutes to eliminate condensation. The 5 mm true tempered glass lens is secured with an "L" shaped gasket, then roll sealed to produce a permanently sealed design. To assure easy reading, the totalizer wheels are large and color coded. The applicable size, model, registration, part number and date code are printed on the calibrated dial face. Moving clockwise during operation, the extra-thin center sweep hand does not interfere with meter reading, and the 1:1 piston ratio low-flow indicator gives visual indication of plumbing leaks. For accurate meter testing, 100 clear graduations appear at the register's circumference.



Magnetic Drive. The magnetic drive design facilitates coupling between the measuring chamber and the external register. The coupling is absolute at all rated flows.

Connections. Meter casing spuds have external straight threads conforming to ANSI B2.1. Bronze coupling nuts and tailpieces are available. Tailpieces have external taper pipe threads conforming to ANSI B2.1. Their lengths and thread sizes are as specified by AWWA Standards.

Maintenance. The measuring chamber assembly can be removed, repaired or replaced. Pretested measuring chamber assemblies are available for exchange or purchase, and spare parts are available from our central warehouse or designated regional locations. AMCO Water staffs and operates a repair facility at its U.S. manufacturing plant in Ocala, Florida.

Pulser Type "BI". The "BI" pulser is a limit switch device which requires power from an external source (2 wire). Contact closure: 1 contact = 1 USG. The switch is rated to 3 amps at 125 VAC max. Note: Register housing and register are 3½ in. diameter style. For full details see specification sheet INDC7-PUL-001.

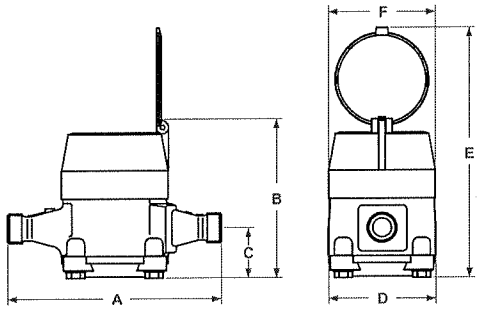
Pulser Type "SFI". The "SFI" pulser is a solid state device which requries 6-24 VDC from an external source (3 wire). Note: Register housing and register are 3½ in. diameter style. Contact closure:

1" Old	24.6 Cont/USG Std.	49.2 Cont/USG Opt.
1" New	30 Cont/USG Std.	60 Cont/USG Opt.

For full details see specification sheet INDC7-PUL-001.

Dimensions and Net Weights

Meter Size	Dimensions (inches) A	B	C	D	E	F	Weight (lbs.)
1"	10 3/4	6 5/8	2 1/8	6 15/16	9 3/4	3 3/4	10 1/5



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APPENDIX C

STORMWATER TREATMENT SYSTEM SPECIFICATIONS

Main O/W Separator Control Panel

Power On

Light should always be on and indicates pumps and control panel have power

Bypass Level Condition

Emergency Alarm. The pit is full at this point and water may be overflowing into the last compartment. Insure pumps are running. Document bypass for required notification to Agency.

Float Switch Trouble

Informational Alarm. Indicates pump automation may not be functioning properly. Acknowledge horn and operate pumps manually as necessary. Arrange maintenance.

High Level (Overflow)

Informational Alarm and turns on second pump. This indicates a very high flow rate at the V-notch. Acknowledge horn and make sure both pumps are on.

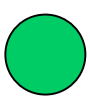
Low Level

Informational Alarm. Indicates pit has been pumped to low and may indicate a problem with "off" float switch. Acknowledge horn and make sure pumps are off.

High Level

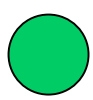
Informational Alarm and turns on second pump. Acknowledge horn and make sure both pumps are on.

Pump 1 On



Light is on when pump is running. South Pump.

Pump 2 On



Light is on when pump is running. North Pump.

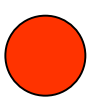
Pump 1 Seal Leak

Light normally off. If light is on it indicates a maintenance issue with the pump. Turn this pump to the Off position and arrange for maintenance.

Pump 2 Seal Leak

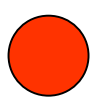
Light normally off. If light is on it indicates a maintenance issue with the pump. Turn this pump to the Off position and arrange for maintenance.

Pump 1 Fail



Indicates the pump should be on but no flow is being detected. Investigate, turn pump off, and turn other pump to on position and operate manually as necessary.

Pump 2 Fail

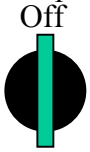


Indicates the pump should be on but no flow is being detected. Investigate, turn pump off, and turn other pump to on position and operate manually as necessary.

Pump 1

Off

Hand

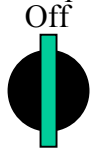


Auto

Pump 2

Off

Hand

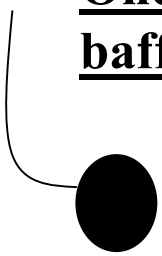


Auto

HI-SHELL001834

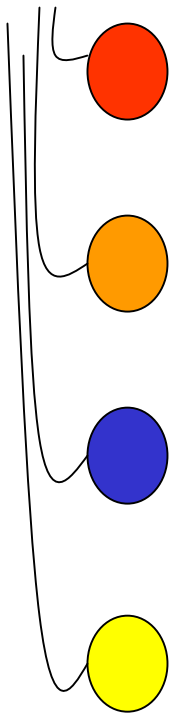
Main Oil/Water Separator Float Switches

One float switch between the steel baffle and the final compartment



Bypass level alarm. This alarm is to inform us that we may be experiencing a bypass of the treatment vaults, document for notification to the WA Dept of Ecology.

Four float switches near the pumps



High level. This float will turn the second pump on and also activate the high alarm on the control panel.

Pump on. When water rises, this float turns one pump on.

Pump off. When water is pumped low enough, this float will turn the pump(s) off.

Low Level. Normally submerged. If water is pumped to low this switch will act as a secondary shutdown for the pumps and cause the Low Level alarm light on the panel to activate

The Stormwater Management StormFilter®

Cast-In-Place, Precast, and Linear Units

Important: These guidelines should be used as a part of your site stormwater management plan.

Description

The Stormwater Management StormFilter® (StormFilter) is a passive, flow-through, stormwater filtration system. The system is comprised of one or more vaults that house rechargeable, media-filled, filter cartridges. The StormFilter works by passing stormwater through the media-filled cartridges, which trap particulates and adsorb materials such as dissolved metals and hydrocarbons. Once filtered through the media, the treated stormwater is directed to a collection pipe or discharged into an open channel drainage way.

The StormFilter is offered in multiple configurations, including precast, linear, catch basin, manhole, and cast-in-place. The precast, linear, manhole, and catch basin models utilize pre-manufactured units to ease the design and installation processes. The cast-in-place units are customized for larger flows and may be either covered or uncovered underground units.

Purpose

The StormFilter is a passive, flow-through, stormwater filtration system designed to improve the quality of stormwater runoff from the urban environment before it enters receiving waterways. It is intended to function as a Best Management Practice (BMP) to meet federal, state, and local requirements for treating runoff in compliance with the Clean Water Act.

Through independent third party studies, it has been demonstrated that the StormFilter is highly effective for treatment of first flush flows and for treatment of flow-paced flows during the latter part of a storm. In general, the StormFilter's efficiency is highest when pollutant concentrations are highest. The primary non-point source pollutants targeted for removal by the StormFilter are: suspended solids (TSS), oil and grease, soluble metals, nutrients, organics, and trash and debris.

Sizing

The StormFilter is sized to treat the peak flow of a water quality design storm. The peak flow is determined from calculations based on the contributing watershed hydrology and from a design storm magnitude set by the local stormwater management agency. The particular size of a StormFilter unit is determined by the number of filter cartridges (see Figure 1) required to treat this peak flow.

The flow rate through each filter cartridge is adjustable, allowing control over the amount of contact time between the influent and the filter media. The maximum flow rate through each cartridge can be adjusted to between 5 and 15 gpm using a calibrated restrictor disc at the base of each filter cartridge. Adjustments to the cartridge flow rate will affect the number of cartridges required to treat the peak flow.

Basic Function

The StormFilter is designed to siphon stormwater runoff through a filter cartridge containing media. A variety of filter media

is available and can be customized for each site to target and remove the desired levels of sediments, dissolved phosphorus, dissolved metals, organics, and oil and grease. In many cases, a combination of media is recommended to maximize the effectiveness of the stormwater pollutant removal.

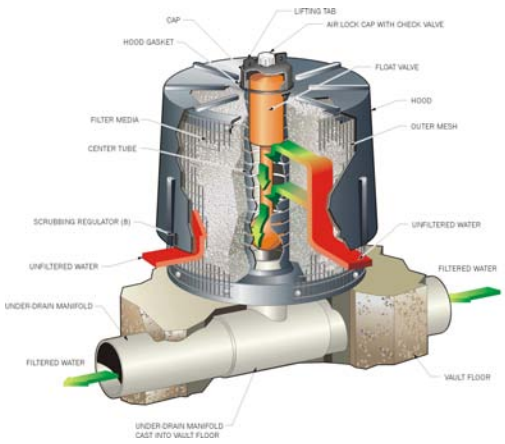


Figure 1. The StormFilter Cartridge

Priming System Function

When stormwater in the StormFilter unit enters a StormFilter cartridge, it percolates horizontally through the cartridge's filter media and collects in the center tube of the cartridge, where the float in the cartridge is in a closed (downward) position.

Water continues to pass through the filter media and into the cartridge's center tube. The air in the cartridge is displaced by the water and purged from beneath the filter hood through the one-way check valve located in the cap. Once the center tube is filled with water (approximately 18 inches deep), there is enough buoyant force on the float to open the float valve and allow the treated water in the center tube to flow into the under-drain manifold. This causes the

check valve to close, initiating a siphon that draws polluted water throughout the full surface area and volume of the filter. Thus, the entire filter cartridge is used to filter water throughout the duration of the storm, regardless of the water surface elevation in the unit. This siphon continues until the water surface elevation drops to the elevation of the hood's scrubbing regulators.

The cartridges are connected to the under-drain manifold with a plastic connector. Since some media used is potentially buoyant, a threaded connector affixed to the under-drain manifold (with glue or other adhesive) is necessary to ensure that the cartridge isn't lifted out of place. For the heavier compost media, a slip connector is used.

The StormFilter is also equipped with flow spreaders that trap floating debris and surface films, even during overflow conditions. Depending on individual site characteristics, some systems are equipped with high and/or base flow bypasses. High flow bypasses are installed when the calculated peak storm event generates a flow that overcomes the overflow capacity of the system. This is especially important for precast systems. Base flow bypasses are sometimes installed to bypass continuous inflows caused by ground water seepage, which usually do not require treatment. All StormFilter units are designed with an overflow. The overflow operates when the inflow rate is greater than the treatment capacity of the filter cartridges.

Maintenance Guidelines

The primary purpose of the StormFilter is to filter out and prevent pollutants from entering our waterways. Like any effective filtration system, periodically these pollutants must be removed to restore the StormFilter to its full efficiency and effectiveness.

Maintenance requirements and frequency are dependent on the pollutant load characteristics of each site.

Maintenance activities may be required in the event of a chemical spill or due to excessive sediment loading from site erosion or extreme storms. It is also good practice to inspect the system after severe storm events.

Types of Maintenance

Presently, procedures have been developed for two levels of maintenance:

- Inspection/minor maintenance
- Major maintenance.

Inspection/minor maintenance activities are combined since minor maintenance does not require special equipment and typically little or no materials are in need of disposal.

Inspection/minor maintenance typically involves:

- Inspection of the vault itself
- Removal of vegetation and trash and debris.

Major maintenance typically includes:

- Cartridge replacement
- Sediment removal

Important: Applicable safety (OSHA) and disposal regulations should be followed during all maintenance activities.

Maintenance Activity Timing

Two scheduled inspections/maintenance activities should take place during the year.

First, an inspection/minor maintenance activity should be done. During the minor maintenance activity (routine inspection, debris removal), the need for major maintenance should be determined and, if disposal during major maintenance will be required, samples of the sediments and media should be obtained.

Second, if required, a major maintenance activity (replacement of the filter cartridges and associated sediment removal) should be performed.

In addition to these two scheduled activities, it is important to check the condition of the StormFilter unit after major storms for damage caused by high flows and for high sediment accumulation that may be caused by localized erosion in the drainage area. It may be necessary to adjust the maintenance activity schedule depending on the actual operating conditions encountered by the system.

In general, minor maintenance activities will occur late in the rainy season, and major maintenance will occur in late summer to early fall when flows into the system are not likely to be present.

Maintenance Activity Frequency

The primary factor controlling timing of maintenance for the StormFilter is sedimentation.

A properly functioning system will remove solids from water by trapping particulates in the porous structure of the filter media. The flow through the system will naturally decrease as more and more solids are trapped. Eventually the flow through the system will be low enough to require replacement of the cartridges. It may be possible to extend the usable span of the cartridges by removing sediment from upstream trapping devices on an as-needed basis in order to prevent material from being re-suspended and discharged to the system.

Site conditions greatly influence maintenance requirements. StormFilter units located in areas with erosion or active construction should be inspected and maintained more often than those in fully stabilized areas.

The maintenance frequency may be adjusted as additional monitoring information becomes available during the inspection program. Areas that develop known problems should be inspected more frequently than areas that demonstrate no problems, particularly after large storms.

Ultimately, inspection and maintenance activities should be scheduled based on the historic records and characteristics of an individual StormFilter system. It is recommended that the maintenance agency develop a database to properly manage StormFilter maintenance programs.

Prior to the development of the maintenance database, the following maintenance frequencies should be followed:

Inspection/minor maintenance
- One time per year
- After Major Storms

Major maintenance
- One time per year
- In the event of a chemical spill

Frequencies should be updated as required.

The recommended initial frequency for inspection/minor maintenance is two times per year for the precast unit. StormFilter units should be inspected after all major storms. Sediment removal and cartridge replacement on an annual basis is recommended until further knowledge is gained about a particular system.

Once an understanding of site characteristics has been established, maintenance may not be needed for one to two years, but inspection is warranted.

Maintenance Methods

Inspection/Minor Maintenance

The primary goal of a maintenance inspection is to assess the condition of the cartridges relative to the level of sediment loading. It may be desirable to conduct this inspection during a storm to observe the relative flow through the filter cartridges. If the submerged cartridges are severely plugged, large amounts of sediments will be present and very little flow will be discharged from the drainage pipes. If this is the case, it is likely that the cartridges need to be replaced.

Warning: In the case of a spill, the worker should abort maintenance activities until the proper guidance is obtained. Notify the local hazard control agency and Stormwater Management Inc. immediately.

To conduct an inspection and/or minor maintenance:

Important: Maintenance must be performed by a utility worker familiar with StormFilter units.

1. If applicable, set up safety equipment to protect pedestrians from fall hazards due to open vault doors or when work is being done near walkways or roadways.
2. Visually inspect the external condition of the unit and take notes concerning defects/problems.

3. Open the doors to the vault and allow the system to air out for 5-10 minutes.

4. Without entering the vault, inspect the inside of the unit, including components.

5. Take notes about the external and internal condition of the vault.

   Be sure to record the level of sediment build-up on the floor of the vault, in the forebay, and on top of the cartridges. If flow is occurring, note the level of water and estimate the flow rate per drainage pipe. Record all observations.

6. Remove large loose debris and trash using a pole with a grapple or net on the end.

7. Close and fasten the door.

8. Remove safety equipment.

9. Make notes about the local drainage area relative to ongoing construction, erosion problems, or high loading of other materials to the system.

10. Finally, review the condition reports from the previous minor and major maintenance visits, and schedule cartridge replacement if needed.

Major Maintenance

Depending on the configuration of the particular system, a worker may be required to enter the vault to perform some tasks.

Important: If vault entry is required, OSHA rules for confined space entry must be followed.

Filter cartridge replacement should occur during dry weather. It may be necessary to plug the filter inlet pipe if base flows exist. Standing water present in the vault should be regarded as polluted and should be contained during this operation by temporarily capping the manifold connectors.

Replacement cartridges will be delivered to the site. Information concerning how to obtain the replacement cartridges is available from Stormwater Management, Inc.

Warning: In the case of a spill, the worker should abort maintenance activities until the proper guidance is obtained. Notify the local hazard control agency and Stormwater Management Inc. immediately.

To conduct cartridge replacement and sediment removal maintenance:

1. If applicable, set up safety equipment to protect pedestrians from fall hazards due to open vault doors or when work is being done near walkways or roadways.

2. Visually inspect the external condition of the unit and take notes concerning defects/problems.

3. Open the doors to the vault and allow the system to air out for 5-10 minutes.

4. Without entering the vault, give the inside of the unit, including components, a general condition inspection.

5. Make notes about the external and internal condition of the vault.

   Give particular attention to recording the level of sediment build-up on the floor of the vault, in the forebay, and on top of the internal components.

6. Remove large loose debris and trash using a pole with a grapple or net on the end.

7. Using a boom, crane, or other device (dolly and ramp), offload the replacement cartridges (up to 150 lbs. each) and set aside.
8. Remove used cartridges from the vault using one of the following methods:

Important: This activity will require that workers enter the vault to remove the cartridges from the drainage system.

Method 1:

a. Using an appropriate sling, attach the cable from the boom, crane, or tripod to the cartridge being removed. Contact SMI for specifications on appropriate attachment devices.

This activity will require that workers enter the vault to remove the cartridges from the drainage system and place them under the vault opening for lifting.

Important: Note that cartridges containing media other than the leaf media require unscrewing from their threaded connectors. Take care not to damage the manifold connectors. This connector should remain installed in the manifold and capped if necessary.

b. Remove the used cartridges (250 lbs. each) from the vault.

Important: Care must be used to avoid damaging the cartridges during removal and installation. The cost of repairing components damaged during maintenance will be the responsibility of the owner unless Stormwater Management performs the maintenance activities and damage is not related to discharges to the system.

c. Set the used cartridge aside or load onto the hauling truck.

d. Continue steps a through c until all cartridges have been removed.

Method 2:

a. Unscrew the cartridge cap.

b. Remove the cartridge hood.

c. Tip the cartridge on its side.

Important: Note that cartridges containing media other than the leaf media require unscrewing from their threaded connectors. Take care not to damage the manifold connectors. This connector should remain installed in the manifold and capped if necessary.

d. Empty the cartridge onto the vault floor.

e. Set the empty, used cartridge aside or load onto the hauling truck.

f. Continue steps a through e until all cartridges have been removed.

9. Remove deposited sediment from the floor of the vault and, if large amounts are present, from the forebay. This can usually be accomplished by shoveling the sediment into containers, which, once full, are lifted mechanically from the vault and placed onto the hauling truck. If Method 2 in Step 8 is used to empty the cartridges, or in cases of extreme sediment loading, a vactor truck may be required.

10. Once the sediments are removed, assess the condition of the vault and the condition of the manifold and connectors. The connectors are short sections of 2-inch schedule 40 PVC, or threaded schedule 80 PVC that should protrude above the floor of the vault.
    a. If required, apply a light coating of FDA approved silicon grease to the outside of the exposed portion of the connectors. This ensures a watertight connection between the cartridge and the drainage pipe.
    b. Replace any damaged connectors.

11. Using the boom, crane, or tripod, lower and install the new cartridges. Once again, take care not to damage connections.

12. Close and fasten the door.

13. Remove safety equipment.

14. Make notes about the local drainage area relative to ongoing construction, erosion problems, or high loadings of other materials to the system.

15. Finally, dispose of the residual materials in accordance with applicable regulations. Make arrangements to return the used cartridges to Stormwater Management, Inc.

Related Maintenance Activities

(Performed on an as-needed basis)

StormFilter units are often just one of many components in a more comprehensive stormwater drainage and treatment system. The entire system may include catch basins, detention vaults, sedimentation vaults and manholes, detention/retention ponds, swales, artificial wetlands, and other miscellaneous components.
In order for maintenance of the StormFilter to be successful, it is imperative that all other components be properly maintained. The maintenance/repair of upstream facilities should be carried out prior to StormFilter maintenance activities.

In addition to considering upstream facilities, it is also important to correct any problems identified in the drainage area. Drainage area concerns may include: erosion problems, heavy oil and grease loading, and discharges of inappropriate materials.

Material Disposal

The accumulated sediment found in stormwater treatment and conveyance systems must be handled and disposed of in a manner that will not allow the material to affect surface or ground water. It is possible for sediments to contain measurable concentrations of heavy metals and organic chemicals (such as pesticides and petroleum products). Areas with the greatest potential for high pollutant loading include industrial areas and heavily traveled roads.

Sediments and water must be disposed of in accordance with all applicable waste disposal regulations. It is not appropriate to discharge untreated materials back to the stormwater drainage system.

Part of arranging for maintenance to occur should include coordination of disposal of solids (landfill coordination) and liquids (municipal vacuum truck decant facility, local wastewater treatment plant, on-site treatment and discharge).

Owners should contact the local public works department and inquire about how the department disposes of their street waste residuals. Stormwater Management Inc will determine disposal methods or reuse of the media contained in the cartridges. If the material has been contaminated with any unusual substance, the cost of special handling and disposal will be the responsibility of the owner.

StormFilter Minor Maintenance and Inspection Data Sheet

Date: _____ **Personnel:**_____

Location: _____ **System Size:** _____

System Type: Cast-In-Place Precast Linear

System Observations

Media Months in Service:_____

Oil and Grease in Forebay: **Yes** **No** _____

Sediment Depth in Forebay:_____

Sediment Depth on Vault Floor: _____

Structural Damage:_____

Estimated Flow from Drainage Pipes (if available): _____

Cartridges Submerged: **Yes** **No** How Deep:_____

StormFilter Minor Maintenance Activities (check off if done and give description)

Trash and Debris Removal: _____

Minor Structural Repairs: _____

Drainage Area Report

Excessive Oil and Grease Loading: **Yes** **No** Source: _____

Sediment Accumulation on Pavement: **Yes** **No** Source: _____

Erosion of Landscaped Areas: **Yes** **No** Source: _____

Items Needing Further Work: _____

Other Comments: _____

Review the condition reports from the previous minor and major maintenance visits.

StormFilter Major Maintenance/Cartridge Replacement Data Sheet

Date: _____ **Personnel:**_____

Location: _____ **System Size:** _____

System Type: Cast-In-Place Precast Linear

List Safety Procedures and Equipment Used: _____

_____

_____

System Observations

Media Months in Service:_____

Oil and Grease in Forebay: **Yes** **No** _____

Sediment Depth in Forebay: _____

Sediment Depth on Vault Floor:_____

Structural Damage: _____

Drainage Area Report

Excessive Oil and Grease Loading: **Yes** **No** Source: _____

Sediment Accumulation on Pavement: **Yes** **No** Source: _____

Erosion of Landscaped Areas: **Yes** **No** Source: _____

StormFilter Cartridge Replacement Maintenance Activities

Remove Trash and Debris: **Yes** **No** Details: _____

Replace Cartridges: **Yes** **No** Details: _____

Sediment Removed: **Yes** **No** Details: _____

Quantity of Sediment Removed (estimate?):_____

Minor Structural Repairs: **Yes** **No** Details:_____

Residuals (debris, sediment) Disposal Methods:_____

Notes:_____